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JOURNAL OF FORESTRY

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EDITORIAL

THE NEED FOR COMMON UNDERSTANDING

THE November and December JOURNAL editorials on "Wild Lands" and "The Cult of the Wilderness" attempted to contribute toward a clearer definition of policy objectives in certain aspects of forest-land use for recreation. The communications published in this issue of the JOURNAL under the caption "The Cult of the Wilderness" are evidence that the editorials aroused thought on rational policy objectives in wilderness preservation. They are also evidence of the need for common understanding of what is really at issue.

One reason for preserving virgin wilderness conditions is the scientific value of well-chosen typical examples of the biotic complexes that result from the free interplay of the forces and processes of nature. These forces and processes are basic for forestry. The forester undertakes to control and use them for the best satisfaction of human needs. To control them, he must understand them; and the preservation of virgin natural areas for purposes of study is a means to this end.

A second reason is the value of the wilderness for human enjoyment, recreation, and inspiration. As our material civilization advances and urbanized ways of living become more and more general, this value is heightened. Both of these reasons for withholding wilderness lands from economic development to make use of their material resources concern definite services to man. They make it possible to apply to the questions of "Where?" and "How much?" our good old touchstone of highest use in the best interest of all.

A third reason has wide acceptance. This acceptance springs from ways of thinking and feeling that are deep-seated in nineteenth century intellectual and emotional life. The return to nature, the broadening and deepening of the appreciation of nature, marked one of the powerful currents running through that century. It profoundly affected popular attitudes, ideals, tastes, and judgments. It had much to do with the forestry movement in the United States. It was closely connected with the romantic movement in literature and art; it influenced religion; it laid a groundwork for deifying and idolizing nature. All of us have viewpoints that have been in greater or less degree determined or colored by it.

Nature undespoiled for its own sake and quite independent of its value as a source of ministration to man's needs and make-up, the conception of a sanctity and perfection which makes the invasion of man for any other purpose than reveren-

tial admiration intrusive and the alteration by human hand or footfall of any detail of the biological complex a desecration—these are examples of a class of ideas for which nineteenth-century romanticism and nature rediscovery made ready a fertile germinative soil. There arises a form of mysticism. Does anyone question that the advocacy of wilderness preservation has made appeal to this readiness of the multitude to concur in a deification of the beauty of virgin nature and to agree that anything which modifies that form necessarily degrades beauty?

The nature mystics hold that virgin wilderness possesses an inherent quality by virtue of its primitiveness which is the most beautiful thing in the world. The assertion is made that through the ages a perfection has been created the preservation of which nature will assure if allowed to continue in her own evolutionary course, but which nature can never restore if once that course is deflected by an external agency. Two underlying ideas are implicit in this theory regarding the workings of nature. The first is the conception of a mystic power in undisturbed nature unerringly to achieve and maintain the expression of rare and exquisite beauty in each changing aspect of a long evolutionary sequence. The second is the assumed impotence of nature ever fully to recover from the effects of a disturbance of the evolutionary march; once the charm is broken, the power vanishes; all that follows must be imperfect, in comparison with what might have been.

The December JOURNAL editorial maintained that a theory of this kind raises questions which fall in the field of aesthetics, not in the field of forestry. Metaphysical abstractions and aesthetic theories take us professionally beyond our depth in strange waters. A dictionary definition of aesthetics reads: "The theory or philosophy of taste; science of the beautiful in nature and art, especially that treating of the expression and appreciation of the beautiful." Familiarity wit metaphysics as well as the philosophy c thought, art, beauty, and nature is in volved. It is a far cry from forestry t metaphysics; nor does the ability to appre ciate—to perceive, evaluate, and enjoy— depend upon ability to think straight an far in the field of aesthetic theory.

While speculative or mystic generaliza tions take us beyond our depth, scientifi ecological fact and experiential reactio to the beauties of nature do not. In bot these fields we may claim to be at hom The assertion that primitive wilderne possesses a beauty which is forever los if the evolutionary course of nature i deflected in ever so small a degree b human interference we cannot directl challenge without entering upon a disput in the field of aesthetic theory; but to th extent that the assertion rests on an as sumed inability of a biotic complex or primeval panorama ever to recover fro the effects of human interference, we ma raise questions. Also, we may reason ably ask ourselves whether the claim tha nature always and infallibly present flawless masterpieces of beauty when onl natural forces are involved correspond with the observed facts in our own ex perience.

Forest science has occasion at times t weigh the effect of nonhuman catastrophi interferences long ago with ecologica associations and formations. How lon the biological effects of the interferenc persist, and to what degree the presenc of extensive mature even-aged stands i a forest region, or of species whose plac in the forest is due to prehistoric fires represent departures from what natur would have produced in the absence o her own interferences, are scientific ques tions. But avalanche, fire, wind, insects and tree diseases are all factors in th evolutionary process of nature throug which, we are told, supreme beauty i attained—beauty which the hand of ma may mar, but not improve. Do we ind

vidually discover in our experiential reaction to the beauty of the wilderness a basis for accepting this esoteric creed?

This editorial, like those in the November and December JOURNALS, is written because of a strong conviction that our public policies relating to the reservation of primitive wilderness areas and the administration of recreational and inspirational forest use are in danger of being led astray by false doctrines. Popular sentiment responds readily to appeals to the love of nature that fail to reckon with all the facts; and foresters are needlessly divided through failure to establish a ground of common understanding regarding the purposes of a rational master-policy. There is no desire, in saying this, to belittle the case for wilderness preservation—on the contrary, the desire is to strengthen the case by clearing away the fog in which false sentimentality tends to enwrap it.

A sound and true basis on which to found our policies is believed to be the one which an article by Dr. John C. Merriam, published in the *National Parks Bulletin* for February, eloquently expressed. Its title is "Human Values in Natural Resources." These values are declared to be threefold: utilitarian values, to be developed and conserved for the benefit of our national economic life; values for the scientific and intellectual study of nature; and values for developing interest in and spiritual appreciation of nature. Nature presents its most favorable aspects under two conditions—complete control of man, as in many English landscapes, and complete primitiveness. Our problem is not only what we need to do to develop or to protect nature, but also what to do to develop our enjoyment of it. Enjoyment, Wordsworth emphasized, comes from within, and if interest in nature and pleasure in its enjoyment are once developed, we have something that gives a light in life wherever we may be. We are attempting to develop landscape art in order to express beauty through nature. We are also attempting to preserve fully something from the original face of nature in such way that later generations may at least know what the Creator was attempting to do when he made the pleasant lands, and the sublime regions where sometimes men worship.

Protection and interpretation of nature in that sense, Dr. Merriam continues, gives an opportunity comparable to development of a great art like literature or painting. There is no substitute for idealism in the development of a program of this nature. We need at this moment, as much as any country ever needed, the development which makes clear the influence of nature upon intellectual and spiritual life; an integration that involves science, the arts, and human interest in order to give clear expression to what is most significant in our relation to nature.

To what sort of a program do these thoughts of Dr. Merriam's point? Some earnest thinking is called for about that.

DEER AND DAUERWALD IN GERMANY[1]

I. HISTORY

By ALDO LEOPOLD

University of Wisconsin

MOST American foresters have heard that German forests are overstocked with deer. But it requires a trip to Germany to get an adequate picture of how severe the deer damage is, and how widely it is distributed.

In the German forests there is no livestock to befog the issue. The observer is soon forced to the conclusion that better silviculture is possible only with a radical reform in game management. Later, as he learns to decipher what silviculture has done to the deer range, he also grasps the converse conclusion that better game management is possible only with a radical change in silviculture.

Germany, in short, presents a plain case of mutual interference between game and forestry. The situation flatly contradicts the uncritical assumption, dying but not yet dead in America, that the practice of forestry in and of itself, regardless of what kind or how much, promotes the welfare of wildlife.

An analysis of this predicament should be rich in lessons for all countries whose conservation policy is still in the making.

Deer and Forestry through Nine Centuries

Our problem thrusts its roots deep and wide into the rich alluvium of German history. It cannot be understood without knowing when and how it grew.

The Urwald.—It must first of all be understood that the Urwald which saw the march of Caesar's legions was predominanatly hardwood. All authorities agree on this fact. At high altitudes the composition tended toward spruce and fir, and on poor sands toward pine, but even these coniferous stands had hardwood admixtures or understory.

Secondly, the Urwald had many openings. This is attested by the numerous forest place-names ending in "heide" (heath), at which no heath or heath-like openings are now to be found.

Such a mixed open forest had a high carrying-capacity for game. Oak and beech offered abundant browse and mast; young conifer-groups offered thick winter cover. In the openings grew a profusion of intolerant food-bearing herbs and shrubs. The native predators automatically adjusted the density of the game to the carrying-capacity of the vegetation. Our hunting progenitors, who plied this game with spear, sling, snare, and broadhead, were, ecologically speaking, simply the predator who had learned to prey with tools.

The game fauna of the Urwald included not only the present red and roe deer, the wild boar, and the Elch (moose),

[1]This paper is based on studies made in Germany and Czecho-Slovakia, August to November, 1935, under the auspices of the Oberlaender Trust and the Carl Schurz Memorial Foundation. For help in gathering the data presented in the charts I am especially indebted to Prof. Franz Heske, Prof. A. Röhrl, and M. Blasius of the Tharandt Forest School; to Dr. Adalbert Ebner of the Bavarian Forest Service, to Oberforster F. Yaerisch of the Prussian Forest Service, and to Prof. Geo. Kartzke of the Carl Schurz Foundation.

but also the Auerochs (ox), the Wisent (bison), and the wild horse, all dependent on openings and hardwoods for feed. We shall never know the equilibria which prevailed in this aboriginal biota, but it is safe to assume that the big game population levels were both stable and high. Had they been either fluctuating or low, our gunless, farmless ancestors would have starved.

On the other hand, Caesar's descriptions show us that the herbivores did not destroy this original forest, nor had they altered its mixed composition.

The Feudal Forests (1100-1400).—These three critical centuries saw hunting evolve from industry to sport. They also saw the gradual diminution of the game stand, including the extinction of the Auerochs and wild horse (about 1364 and 1425, respectively), and the virtual elimination of the Wisent. As an offset to these losses came the introduction of the fallow deer from Asia, via France. There was as yet neither forestry nor game management, but there was a deliberate effort to conserve oak and beech mast trees, for the combined benefit of game and domestic swine.

Deer hunting was done with bows and nets. The use of nets dates back to 1100. They were set in the openings of planted hedges, and the deer were driven into them with dogs.

No statistics of kill exist, but a general downward trend in deer may be inferred as the natural consequence of the spread of agriculture, the mania for hunting, and the lack of both restrictive laws and management. This inference is sustained by the absence of recorded complaints over deer damage.

The Big High (1400-1618).—Sometime about 1400 was born the idea of deliberate organized *Wildbestandhebung* (lifting the game stand) which marks the advent of game management in Germany. There resulted such high of deer as Germany had never seen, and will never see again.

The practice of management began with agreements or treaties between adjoining domains. The ideas of national federation which culminated under Bismarck may well have had their origin in these simple deer-treaties between local rulers.

By 1545 we find the professional game manager firmly entrenched in the overhead personnel of each petty court. He was called a forester, but had only game and military duties. A contract of employment between the Archbishop of Tollenn and one Thysenn of Thylge, his forester, describing the latter's emoluments, perquisites, and duties, is given by Feaux de la Croix and affords the modern forester much information and not a little amusement. The clergy as well as the nobility were the huntsmen of this period.

Systematic kill records appear only at the end of the period, i.e. about 1600.

Game management took the form of rigid patrol, savage penalties against trespass, deliberate preservation of mast trees, voluntary restraints on the kill, and predator control. These measures were applied to a forest still natural in its composition; a forest probably cut, burned, and grazed in just that intermediate degree favorable for the release of the accumulated energy of the Urwald. Just so, in America, the period of maximum wild life abundance came just after (not before) the ecological disturbances resulting from settlement. Yet despite the high density of deer, it is not until the end of the period that we find records of forest damage—a fact which speaks volumes for the carrying capacity of the hardwood forest.

The "Big High" and the system of management which produced it toppled to an abrupt end with the outbreak of the Thirty Years War (1618-1648).

The Exploitation (1718-1700).—The Thirty Years War decimated the game in two ways: by the disorganization of man-

agement and patrol, and by filling the woods with outlaws, military fugitives, and evicted peasants, all of whom turned to venison for a livelihood. Heske also notes a reinvasion of bears and wolves during the Thirty Years War.

The shrinkage in deer of course terminated the deer pressure on the forest. This continuous interaction between game, forest, and politics is beautifully illustrated in the famous oak stands of the Spessart, which owe their origin to the following fortuitous succession of events (see Forstverein Jahrbuch, 1935, pp. 23-24):

1. The Bishop of Mainz, like most of the ecclesiastics of his time, loved hunting. His favorite hunting ground was the south slope of the Spessart. Up to 1605, he protected this forest against both agricultural exploitation and cutting. The deer, while thus protected, became so abundant as to make oak reproduction impossible.

2. The good bishop also desired a new castle which should outshine all the other castles of Germany. This impelled him to cut out, in one great felling, for timbering his castle (Aschaffenburger Schloss) all but the old, short-stemmed, large-crowned oaks of the Spessart. His draft-oxen, in the course of the logging, grazed out the undergrowth, and scuffed the freshly-exposed soil of the new slashings.

3. A prodigious mast-year came along and seeded the slashings thus accidentally prepared with millions of acorns.

4. At the same moment the Thirty Years War broke out, causing the game "by reason of the increase in predators and the disturbances in the forest by fugitives" to decrease. This enabled the new seedings to grow into a jungle of young oaks.

5. The game stayed down long enough for the oak seedlings to grow out of its reach. Hence the towering, slender shafts, fine-grained wood, and small, compact crowns and roots of the modern Spessart, which stands, silviculturally speaking, as the first wonder of the world.

The north slope of the Spessart, which is intrinsically a better site but had no hunting bishop to watch over it, fell a victim to exploitation during the 1600's and 1700's. This was later followed by pure-conifer silviculture. This north slope now supports only a mediocre stand of Scotch pine, which, when compared with the Spessart, would hardly be recognized as belonging in the same region.

Systematic records of deer bags begin with the 1600's. (See Fig. 1.) These records take the form of a combined Journal and Guest Book for each estate. Sometimes the Journal records the kill of a personage or a court rather than of an area (Fig. 1A). Sometimes the kill of the ruling family and guests is separated from that of its employees. Some Journals begin in the 1300's, but either these early data are too indefinite to compile or no one has ever taken the trouble to go back that far. The best game Journals are in Bohemia and Saxony. Official statistics of political subdivisions also furnish kill data, but do not appear until 1855 (Fig. 2, B, C, D).

The old Journals show that some forests recovered their deer-stands immediately after the Thirty Years War (Royal Forests of Saxony, Fig. 1A); most, however, remained depleted until the early 1700's (Wittingau, Fig. 1 C).

The close of the 1600's saw nets and bows replaced by firearms and the final extirpation of bears (1693) and wolves (1742), even from large estates like Wittingau. (While it has nothing to do with deer, there may also be noted the introduction of pheasant culture (Krumau, 1687) and the appearance of protective closed seasons on threatened species (Auerhahn at Bastenberge, 1684).

The 1600's were a period not only of game scarcity but of forest exploitation. There was a wide prevalence of new

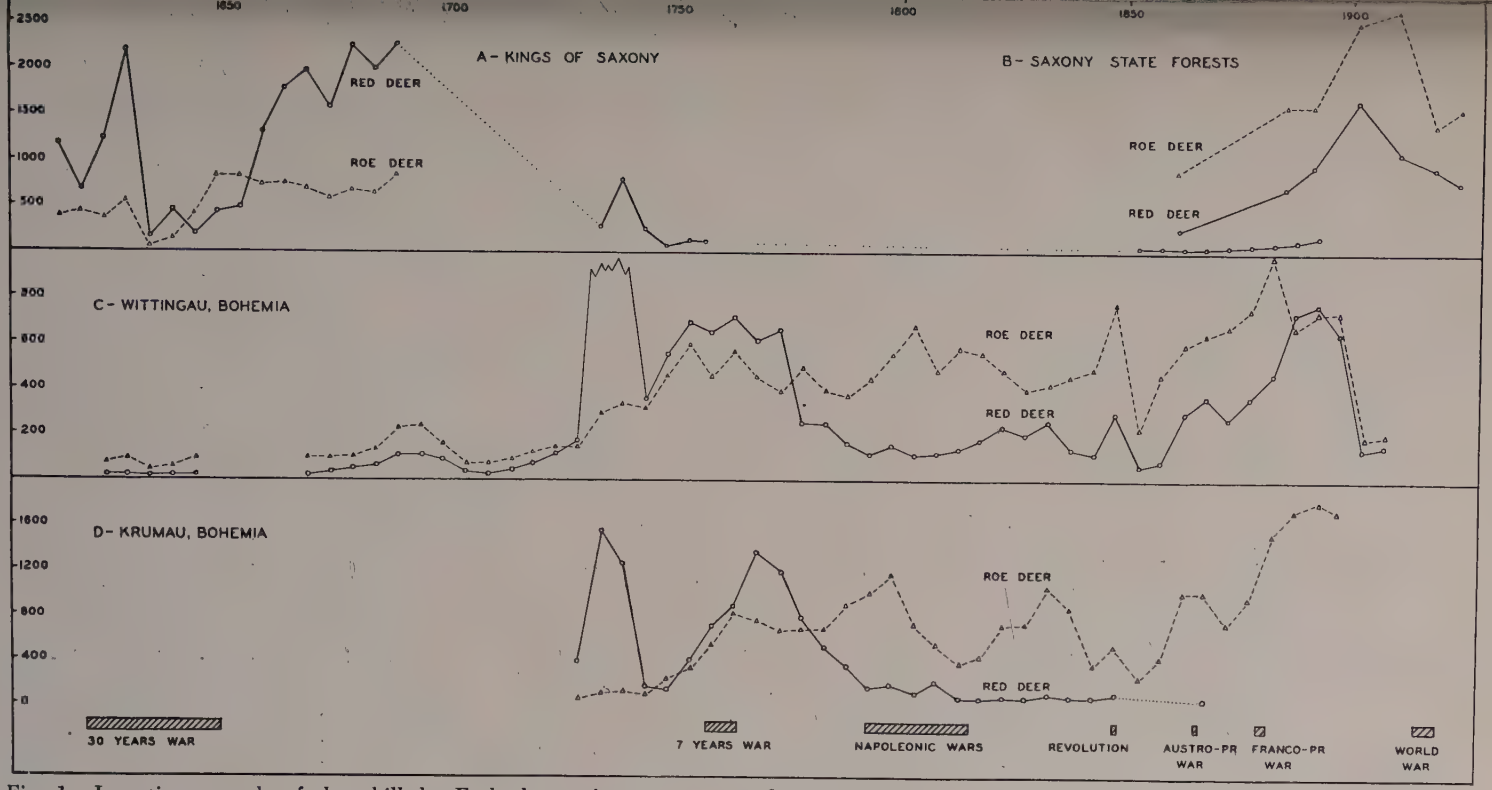

Fig. 1.—Long-time records of deer killed. Each data point represents a five-year average. Fallow deer are omitted because the kill is usually too small to plot on the same scale as red and roe deer.

(A) Kings of Saxony. This is the bag of the Saxon Court, and probably represents an indeterminate area. Changes in area, in intensity of hunting, and in completeness of the record probably occur for each of the five Kings represented, namely: 1611-1656, Johann Georg I; 1656-1680, Johann Georg II; 1680-1691, Johann Georg III; 1733-1756, August III; 1844-1895, Albert. (For first three see H. St. A. Rep. XVIII Gen. 498 Loc. 38184. For fourth see Tharandter Forst. Jahrbuch 1863, p. 283. For fifth see König Albert und das Edle Weidwerk, p. 106.)

(B) Saxony State Forests. Area about 410,000 acres in period 1914-1923; somewhat smaller earlier. (Data from Putscher, Tharandter Forst. Jahrbuch, 1934, p. 531.)

(C) Wittingau. An estate of Prince Schwartzenburg. Area including leases about 120,000 acres. (For description and data see Heske.)

(D) Krumau. An estate of Prince Schwartzenburg. Area assumed to be 50,000 acres. (For description and data see Saitz.)

clearings and slashings, and probably of destructive grazing.

The Timber Famine, 1700-1810.—This is a period of high deer and low forests. It opens with a general rise in all deer curves, which is sustained, except as temporarily interrupted by wars and hard winters, until the Revolution of 1848. Two especially hard winters came in 1726 and 1729.

About the middle of the century the roe curve crosses the red deer curve. Henceforward the little roe is to be the more abundant of the two species, whereas during the Middle Ages roes were scarce, and in low esteem as game.

A whole series of ideas pertinent to thee forest-game relationship had their birthi during this century. There were, in Saxony at least, earnest but unsuccessfull efforts to reorganize forest administrationn for better coordination of game and forestry. There was a timber famine, and aa consciousness of worse to come unlesss offset by deliberate timber-cropping. Thee cropping took the form of coppice, andl later of birch. Both were intended ass silvicultural short-cuts, and perhaps represented the equivalent of the presentt American idea of "cellulose forestry."" (The human mind seems to recoil when itt first faces the time element in forestry,,

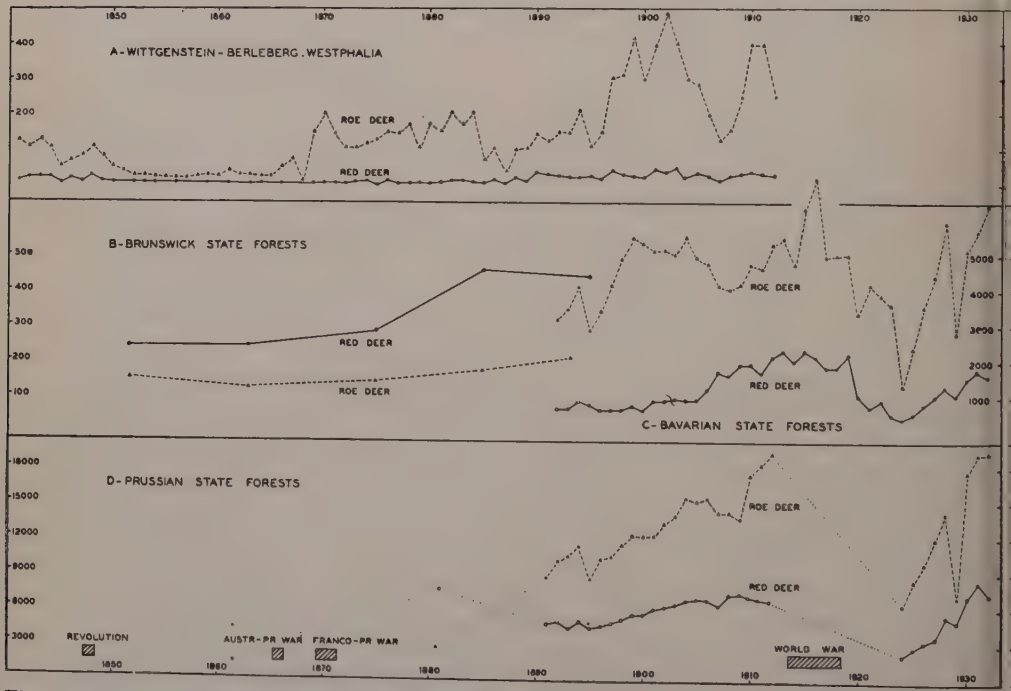

Fig. 2.—Shorter records of deer killed. Each data point represents a single year. Fallow deer are omitted.

(A) Wittgenstein-Berleberg. An estate of Westphalia. Area unknown. (For description and data see Feaux de la Croix, p. 296.)

(B) Brunswick. Area uncertain. (Data from Bieger, p. 21.)

(C) Bavarian State Forests. Area, including leases, about 1,375,000 acres in 1910, somewhat larger later, smaller earlier. (Data compiled from original records by A. Ebner.)

(D) Prussian State Forests. Area about 7,000,000 acres. Data compiled by M. Blasius from "Amtliche Mitteilungen aus der Abteilung für Forsten des Preussischen Ministerium für Landwirtschaft, Domänen, und Forsten."

but today the Germans calmly execute rotations of 100 and 300 years, secure in the knowledge that they represent good economics. The present German appraisal of the birch-bonanza is implied in Le Roux's derisive term "Betulamania.")

The wolf of timber famine at the door did not immediately put an end to slashings, either in Germany or America. Frederick the Great, in order to pay his debts of the Seven Years War, cashed in on all the good oaks in the Schorfneide, floating the logs to tidewater. The old oaks now remaining are the "unmerchantable" residue. But unlike the Bishop of Mainz, he proceeded to build up a heavy deer stand on the slashings, which consequently could not reproduce except to a few unpalatable birches and hawthorns. This area became the favorite hunting ground of subsequent rulers, including the Kaiser, and now of Reichsjägermeister Göring. The present stocking is a deer per twenty acres. The Schorfheide, thanks to deer, remains to this day the most open forest in Germany. It contains savannas of good forest soil (too good to revert to heather) which could actually be called meadows or parks.

E. E. Carter tells me the Romintenheide, in East Prussia, also has large deer-made savannas, but in this case the original "slashing" was made not by an emperor, but an insect. It was cleared by nun-moths in 1855.

The Schorfheide savannas furnish us another curious example of the interdependence of game, forest, and politics. They are interspersed with glacial lakes containing sphagnum bogs. Outside the forest are grainfields. When one combines savanna, sphagnum-bog, and fields, one has a breeding range for cranes. The cranes are there—eight pairs—one of the few remaining colonies in central Europe,

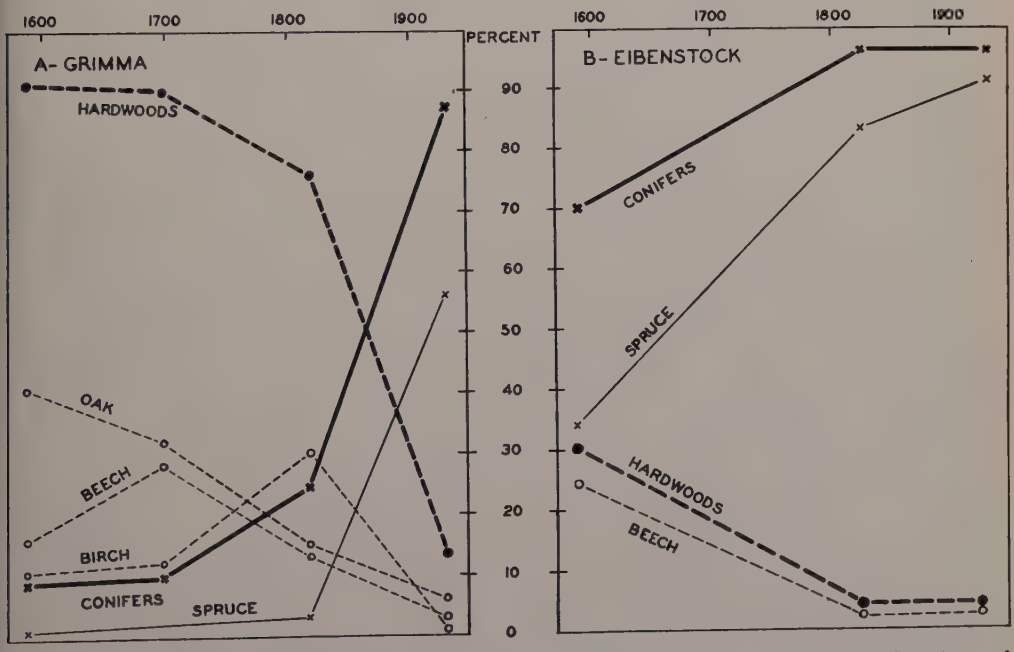

Fig. 3.—Conversion of mixed forest to conifers since 1591. These two Inspection Districts of the Saxony State Forests have a combined area of 85,000 acres. Grimma (A) consists of 7 lowland reviers and was originally hardwood. Eibenstock (B) consists of 9 mountainous reviers and was originally part spruce. Data from Dissertation of Dr. Kienitz, Tharandt Forest School.

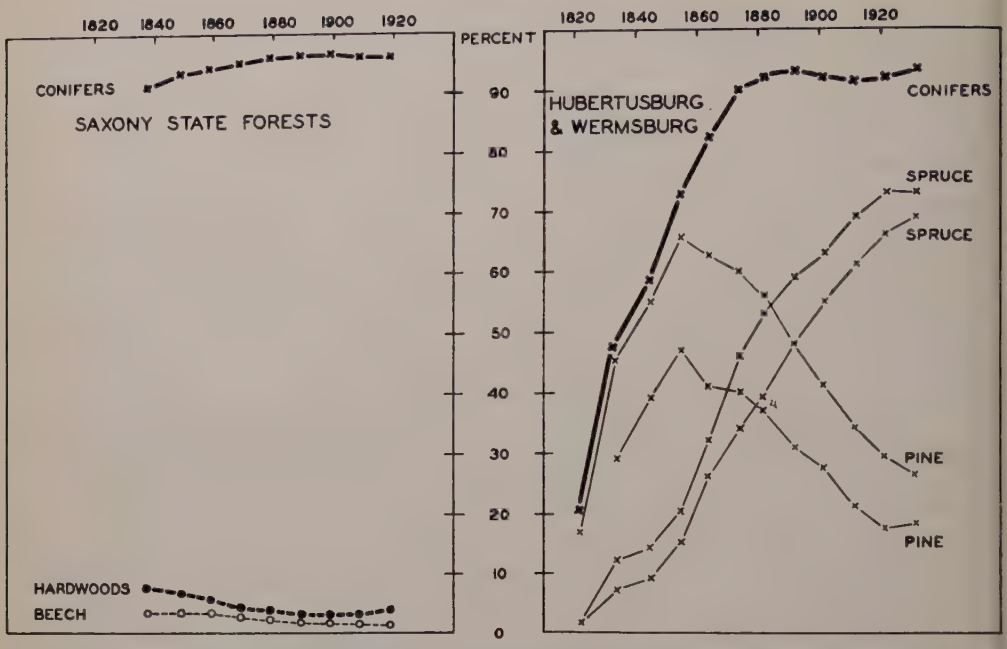

Fig. 4.—Conversion of mixed forest to conifers since 1822. The Saxony State Forests (A) had an area of 410,000 acres at the last census. Considerable conversion had evidently been accomplished prior to 1838. Data from Deutscher Forstverein. The two reviers (B) lie within the Grimma Inspection District (see Fig. 3A). The graph shows the details of conversion since 1822. Even pine has shrunk at the expense of spruce. Data from Leroux.

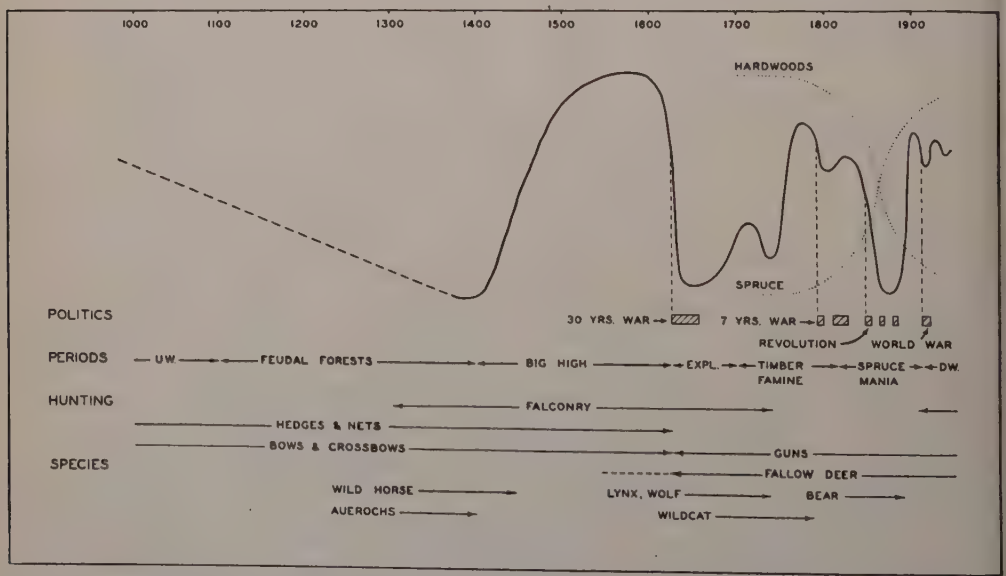

Fig. 5.—General trend of deer population and forest composition. The curves are based upon but are not a mathematical summation of the data in Figs. 1, 2, 3, 4. Historical periods and events appear below.

and now happily protected by the equivalent of a National Park.

In the central Wisconsin marshes we also have breeding cranes, but here the savanna was created not by the war debts of an emperor, but by the drainage boom of the inglorious 1890's. Fires, instead of deer, keep the timber down. The timber is oak and tamarack instead of oak and pine. But the two areas, to a crane, are alike, as attested by their survival in both.

The 1700's saw the final eradication of the remaining large predators, the lynx in 1727, the wolf in 1742, and the wildcat in 1775. The era closes with a sharp downward trend in deer, and a growing effort toward serious long-time forestry, both of which are further discussed below.

The Spruce Mania (1810-1914).—In and around the Revolution of 1848, German deer fell to an extreme low, comparable to that during the Thirty Years War. The sharpest part of this decline reflects the brief and unsuccessful democratization of hunting privileges arising out of the revolution itself. There was also the usual breakdown of patrol and management. American foresters are doubtless aware that the heaviest German immigration to America was caused by the political persecutions of this period.

The early 1800's brought a revolution in forestry as well as in politics. There was a general stampede toward the planting of spruce, which the Germans, in retrospect, call "Fichtenomania." Never before or since have the forests of a whole nation been converted to a new species within a single generation. Spruce was pushed downward and outward far beyond its natural range. The beginning of the spruce era is usually dated as 1820, when Cotta, who had started the movement, took over the Tharandt Forest School. The actual plantings, however, must have begun earlier, for we find the conversion to spruce completed at Colditz by 1860. Such a radical change could hardly have been completed in less than one rotation. On dry sands where spruce would not grow, pure pine was used instead. In both species the silvicultural system was clear cuttings (*Kahlschlag*) followed by planting. Mixed forests and natural reproduction both became archaic relics of an unenlightened past. Data on this conversion appear in Figs. 3 and 4.

As early as 1810 we find mention of a decrease in all game, and in 1829 heavier deer kills are ordered throughout Saxony. It seems likely that this reflects a shrinkage in feed, and a growing solicitude over deer damage, due to conifer plantings. The spruce mania, in short, probably had much to do with starting that decline in deer to which the Revolution gave the final *coup de grace.*

Hot on the heels of the revolution begins another big rise in deer, which culminated in two peaks, one just before 1900 and the other just before the World War. The accomplishment of this *Wildbestandhebung,* spruce or no spruce, must be ascribed to artificial feeding. In its later stages, I suspect it can also be ascribed to the amelioration of deer damage by factory-made wire. (When we invent a new machine, we usually assume that its use makes us immune to the ecological penalties which other flesh is heir to. This mechanistic arrogance is, to a conservationist, the keynote of the century.)

The nature of the struggle to reconcile high deer with pure conifers is indicated by a few thumbnail sketches of typical items. In 1854 Crown Prince Albert ups his deer and tries to offset this by administrative coordination. In 1857 the remaining servitudes for litter and grazing are bought out at Bärenthoren (perhaps the rising tide of deer and conifers creates an impulse to clean up other and less immovable forest troubles). In 1873 heavy deer damage leads to the leasing-out of

many reviers in Saxony, which the King alone could not keep properly shot down.

At the end of the century we find the first rumblings of reconversion to hardwoods. The Kaiser, viewing the deer-made savannas of his hunting ground at the Schorfheide, orders them planted to oak. But he will have no tiny seedlings such as pottering foresters use; he wants action, quick, in the true imperial manner. So large oak transplants, duly fenced, are installed. It is said to be a characteristic of German oak that large planting stock grows scrubby, even on good oak soil. The young trees were also cut back, preparatory to the removal of the fence, so as to grow stiff stems which the deer could not browse by "riding" them. Today we see, plumped down upon that lovely landscape, a series of square, scrubby, deer-pruned oak thickets, a monument to the collision between imperial impatience and the laws of nature.

Dauerwald (1914-1935).—The spruce mania arose out of Cotta's discovery, about 1810, that massed stems of spruce, even though individually fine-ringed, outyielded in the aggregate the less numerous stems of the natural forest, and returned a higher land rent.

The second and third rotations, however, failed to repeat the superior increment realized from the first. Yields progressively declined, especially in forests outside the natural range of spruce. Litter failed to decay, piling up on the forest floor as a dry, sterile blanket which smothered all natural undergrowth, even moss. Roots ceased to penetrate the soil, lying in a tangled mat between the soil and the litter, with so many root grafts that cut stumps formed healing calluses by reason of their connection with nearby uncut trees. The topsoil developed excessive acidity, became bleached, and was separated from the subsoil by a dark band. These conditions became known as "soil-sickness," and are now technically understood as podsolization—an accumulation of surface acids due to the lack of hardwoods to pump up bases from the subsoil. Windfalls increased, due to shallow anchorage. Insect epidemics swept through the unbroken regiments. In short, pure spruce, the precocious child of timber famine and "wood factory" economics, grew up into an unlovely and unproductive maturity.

The inevitable reaction against these silvicultural excesses—the return swing of the silvicultural pendulum—is labelled *Dauerwald* (literally "permanent woods."). The term implies selection system, natural reproduction, and indirectly hardwoods. The main principles of Dauerwald are now legally mandatory, and their practice has begun in some degree in many forests, but the main proving ground for its techniques—the focal point of its ideas—is, by common consent, the Forest of Bärenthoren, in Anhalt. The initial departures from the reinkultur idea at Bärenthoren date back to 1884. The definite national recognition of the superiority of mixed forest may be dated as beginning in 1918. The first formal publication of silvicultural measurements at Bärenthoren was in 1924. A new series of decennial measurements appeared in 1934 (Krutsch and Weck). These measurements, roughly speaking, show double the increment set as standard for this site quality by Schwappach. In general, it is now conceded that mixed forest, naturally reproduced, outyields pure conifers in the long run. Speed of reproduction, decay of litter, self-pruning of trees, rate of stump-rotting, and other indices to ecological health are speeded up to an almost phenomenal extent.

But no reform is ever without its irony. Even Bärenthoren has its deer per 9 acres. The beech is brought in, laboriously, under fence.

Some forests, though, have made really

substantial reductions, and are reproducing beech naturally, in the open. Thus Bärenfels, in Saxony, cut its deer by two-thirds between 1919 and 1935. In 1919, 75 per cent of the spruce poles showed Schälschade (bark-peeling); now there is no damage, and carrying capacity is patently on the up-grade.

The nine centuries of history which we have now sketched in broad outline are summarized in Fig. 5. An effort was made to express the deer curve in Fig. 5 as a mathematical summation of the recorded kills in Figs. 1 and 2. This, however, proved to be impossible because it involved reducing all kill data to a common denominator of area. The gross areas are known, but not the areas of range for each of the two species. Since a red deer represents perhaps four times the grazing pressure of a roe, there was no way to add the two without knowing the areas of each. For these reasons the deer curve in Fig. 5 is hypothetical in respect of the comparative elevation of the several highs. In all other respects it may be regarded as mathematically valid.

We have dealt, so far, with the historical trends of deer and forests; ending with the simultaneous rise of deer and conifers during the past century. We have raised the question of whether and how these two incompatible cultures can continue to coexist on the same land. The ecological evidence bearing on this question, together with a discussion of policy, will be covered in the next issue of the JOURNAL.

KAPPA CHAPTER BECOMES PRESIDENT CHAPTER OF XI SIGMA PI

XI SIGMA PI, the national forestry honorary fraternity, was founded at the University of Washington College of Forestry in 1908, by Dean Ballard and Clarence B. Keith, students in the college. Beta chapter was organized at Michigan State College in 1916, and Gamma chapter at the University of Maine in 1917. In 1920 Delta and Epsilon chapters were organized at Minnesota and Idaho. In 1921 Zeta chapter at Oregon State, in 1924 Eta at Penn State, and in 1925 Theta at California. Kappa chapter was installed by Professor H. S. Newins at Purdue in May, 1934.

Kappa chapter was elected as president chapter for 1936 and 1937. The national officers of the fraternity are members of the forestry staff of Purdue University. They are as follows: Prof. Chas. G. Geltz, National Forester; R. C. Brundage, Associate Forester; Prof. Daniel DenUyl, Secretary and Fiscal Agent.

The national officers are desirous of publishing a new directory. There are a good many men who are not in touch with their alma maters, but who read the JOURNAL. We should appreciate hearing from you, giving your official title, location, and nature of your work. Either that, or be sure your own chapter has the latest information about you.—CHAS. G. GELTZ, *Purdue University.*

OBJECTIVES OF THE NORTH AMERICAN WILDLIFE CONFERENCE

By F. A. SILCOX[1]

WE are assembled here in a common effort to help restore and conserve the vanishing wildlife resources of a continent.

This is a serious purpose. It has wide scientific interest and significance. Its aesthetic, spiritual, and recreational values are enormous. It affects the social and economic welfare of some 150 millions of people, in three great nations.

It seems inevitable to me that this Conference should have been called; inevitable that it should have been called by the President of the United States; inevitable that the President who called it should have been a Roosevelt. For Theodore Roosevelt and Franklin Delano Roosevelt are both indelibly identified with the principle of conservation of our natural resources. Each of them has anticipated the need for it, and has recognized the vital relations which it bears to an economy that has for its foundation some degree of security and stability for the people of a nation. Both have held, always, that conservation is a matter of immediate, vital concern to all regions and all nations; to all groups and all people, irrespective of business, political, or other affiliations.

This is the spirit in which the North American Wildlife Conference was called; the spirit in which I accepted appointment as its Chairman; the spirit in which you, as representatives from every nation, state, and interested group in North America, have assembled here. It is the spirit in which your distinguished Committee prepared the agenda which assures each of you an opportunity to make known his viewpoints and beliefs, to discuss and offer constructive suggestions. It is the spirit with which this Conference will conduct its deliberations and arrive at its conclusions.

It is, in fact, the spirit of true democracy.

By its very nature, this Conference is in effect a meeting of the peoples of a Continent. It is entirely autonomous. Its perpetuation, its future aims, aspirations, and methods of representation, are subject to its own decisions. The hope is that through its deliberations new cooperation between private, public, and international interests will develop; that from it will come constructive proposals; that through these proposals there may be evolved such intelligent, concerted, and cooperative action as will help restore and conserve some semblance of our original wildlife resources.

This is a huge task. It has certain very practical limitations. *Pioneer* conditions can never be restored. We may long for them, but we must admit that never again will it be possible for man to see in the valley of the Yellowstone what Captain Reynolds described in 1860 as a tract of 40 or 50 square miles so thickly covered with buffalo that it looked like a small pasture into which a large drove of cattle had been turned for a single night.

We know, too, that never again will the broad valleys of the Upper Missouri support, as the Lewis and Clark journal reveals that they did in 1805, an aggregation of wildlife—including buffalo, elk, antelope, deer, moose, bighorn sheep, grizzly bear, prairie chicken, geese, and

[1]Chief of the Forest Service and by appointment from the President, Chairman of the Conference. Opening address delivered at the Conference in Washington, D. C., February 3, 1936.

ducks—that for number and variety exceeded anything the eye of man had ever looked upon.

These pictures of early abundance are typical of pioneer days in the West. Comparable conditions once existed in the North, the South, and the East. The country was virgin then, with a biotic balance in fauna and flora undisturbed by the white man's presence. Since then much has happened. With the building of western railroads, buffalo were killed by the tens of thousands for their tongues alone; hundreds of thousands were slaughtered for their hides. Elk were killed for a pair of tusks; deer and other elk for their hides. Huge construction camps were fed chiefly on antelope. Then, to help support the rapid influx of settlers, fences were built, sod was plowed under, ranches appeared, prairies were pastured by sheep and cattle, until original environments largely disappeared; and with them, much of our wildlife.

In addition, then, to the slaughter and waste of pioneer days, this destruction of favorable environments has in itself been a major cause of our present wildlife plight. And it is now one of the obstacles to be overcome in solving the problem of restoring our wildlife resources.

Wildlife environments can not now be restored to these pioneer conditions which once existed on broad areas which are now in urban and rural occupancy. That is neither physically possible nor socially desirable. But they can be restored to the extent that wildlife may again play the part it should in the social and economic life of a continent; we can still do a great deal, through improving environments, to better the present wildlife conditions on them. And it is, after all, the present rather than pioneer conditions with which we now must deal.

How may these and other things be done? And where, and by what agencies? To gather and make available information on these points, and about other pertinent facts and discoveries, is one of the purposes of this Conference. Opportunities for discussion are provided in a series of carefully planned forenoon sessions. I urge wide participation in them, for clear understanding and honest approaches to such problems are essential to the restoration and conservation of North American wildlife.

On many of these problems divergent points of view are held. Differences in some cases are between individuals. In others they are between technical and professional groups, or between laymen and technicians; between regional groups; or between groups which represent public and those which represent special interests. So long, however, as these differences are honestly held and at this Conference are honestly and clearly expressed, they should help both to define problems with which we are faced and to devise practicable methods to solve them. Both these things spell real progress toward a common goal.

There is need for progress, for by comparison with pioneer conditions the present wildlife picture is in most sections of the United States one of scarcity or want. Buffalo, reduced from former millions to some 4,400 head, are confined very largely in a semidomesticated state to preserves and reservations. One species of white-tailed deer which formerly roamed western Washington is extinct. The last white-tailed deer is reported to have disappeared from Yellowstone Park in the winter of 1923-24. Pronghorned antelope, now on the increase within reservations and refuges, are nevertheless reduced from some 30 to 40 millions to an estimated sixty odd thousand.

Mountain goats, moose, many species of migratory waterfowl, and grizzly bear are scarce. It is a hard struggle for them to hold their own. Elk are so decimated that in 1904 domestication was

urged as the only practical method of preservation. Food fish in the Great Lakes and in long stretches of both coastal waters are approaching exhaustion. Game and food fish in most major rivers and streams are gone or reduced to a shadow of their former numbers. Certain species of songbirds are so scarce as almost to be classed as museum specimens. Upland birds and fur bearers, existing as scattered remnants of former abundance, are still declining. Canvasback and redhead duck are on the way out. The whir of heath hen and passenger pigeon is gone from the land.

Pastures have replaced prairies, dust-storms becloud and befoul vast areas which were once wildlife breeding grounds. On National Parks and National Forests wildlife is increasing, but much of our privately owned range land and public domain is depleted. Streams and harbors are polluted by municipal and industrial wastes. Fences and "no trespass" signs greet devotees of camera, rod, and gun. Traditional opportunities and joys of the hunt are increasingly curtailed and restricted. Political expediency is too often the rule in wildlife affairs. Over the length and breadth of the land fishermen and hunters, bird lovers and recreationists, city dwellers and urban folk, fathers and sons, scientists, sportsmen, and laymen are disheartened and discouraged at conditions which you, who represent them here, know so well.

It was with these conditions clearly in mind that President Roosevelt issued his call and set the dates for this North American Wildlife Conference. It was a clear call, and a clarion one. Recognizing no single region or no single group, it was addressed to the millions of people who, individually and in thousands of groups, societies, unions, and leagues, have worked valiantly and long to promote local and group interest in certain phases of wildlife restoration and conservation.

Our President's call was, then, a national and an international one. It recognized the broad wildlife plight, and the urgency of it. Through the medium of this Conference and the open covenants which he hopes it may bring forth, his call provides an opportunity to remedy that plight.

I have every confidence that the Conference will in good faith and with a high heart make the most of this opportunity. Certainly it is representative enough to do so. Certainly it has within it—and at its command—the brains, the intelligence, and the expert knowledge to do so. Its members and their constituents have, too, ample background, a wealth of practical experience, the common sense to look to the past for guidance but not blindly to follow the past. And I know the men and women here have the courage to propose such new methods and adopt such bold action as may be necessary successfully to accomplish the common purpose.

But with all the brains, all the experience, all the courage and all the high resolve that is gathered here, that purpose can not be accomplished if individuals and groups stick to their own particular lasts or fail of such a practical approach as will assure due consideration to economic requirements of existing social structures. If wildlife is to be restored and conserved, all factors must be weighed and evaluated and individual action and unconcerted group and regional action must be correlated, coordinated, and fused into cooperative national and international planning and action for the good of all.

It is unnecessary to take any man's word for the need for this. Look for a moment to the past, for there ample confirmation lies. Wildlife organizations have existed for many years. Their numbers have been—and are—in the thousands;

the number of their conscientious, courageous, zealous members mounts to many millions. Their potential strength has been—and is—enormous. Working long and faithfully and hard, they have accomplished certain things. But in all the years of work they have had neither a common program nor a single, effective, non-partisan, central organization. For such a purpose as restoration and conservation of the wildlife of a nation or a continent, they have therefore been leaderless, rudderless, and inarticulate; their work has often been at cross purposes; their results an indiscernible ripple in the relentless, ever-ebbing wildlife tide.

This Conference offers a way out. It can be effectively articulate. It can lay the groundwork for a united national wildlife program. Without disturbing existing organizations, invading occupied fields of activity, or usurping a single sacred prerogative, it can through your initiative and determination affiliate all wildlife organizations and interests; can create a single, powerful union through which the potential strength of thousands of affiliates and millions of their own individual members may effectively be brought to bear upon that common objective, the restoration and conservation of North American wildlife.

By direction of your Citizens' Committee,—which as you know is composed of twenty-five outstanding conservation leaders,—certain tentative proposals for organization will later be submitted for your consideration. When time for action comes, I urge you to remember that by its very nature this Conference is in effect a meeting of the peoples of a Continent; that it is entirely autonomous; that in accordance with the spirit of true democracy its future aims, aspirations, and methods of doing business are in its own hands.

This Conference provides, then, three major opportunities. One is to learn about facts, discoveries, and information pertinent to wildlife and the wildlife situation. Another is to develop an adequate national and international wildlife program. A third is to organize a permanent affiliation of all wildlife interests and groups; to create one central union so articulate, so powerful, and so effective that real progress in restoring and conserving the vanishing wildlife resources of a continent can no longer be prevented.

A Rule of Thumb for Fenceposts

THE following rule of thumb is used in southern Iowa for estimating the number of fenceposts which can be cut from 6½ foot bolts: "Multiply the top diameter of the bolt by 3 and divide by 4." The standard post is 6½ feet long, and must measure at least 4 inches in the longest cross-sectional dimension at the small end. —Joseph B. Ely, Jr., *U. S. Forest Service, Keosauqua, Iowa.*

PROPOSAL OF NEW FORESTRY LEGISLATION

The Joint Committee of the National Forestry Conference has drafted a bill embodying various changes in the present federal forestry legislation. An account of the situation giving rise to the legislative proposals and a summary of the provisions of the bill has been given out by the Joint Committee. The following article is in the main a condensation of the Committee's statement, which is too long for reproduction in the JOURNAL.—EDITOR.

READERS of the JOURNAL have been informed from time to time of the developments that followed the adoption of the Lumber Code as one of the means for giving effect to the National Industrial Recovery Act. Under that Code the participating lumber and timber products industries assumed an obligation to insure forest replacement and continuous production. This obligation was stated in the famous Article X.

Article X also provided for the convocation of a joint conference of representatives of the industries and public agencies to set up practical means for carrying out the obligation. This conference was followed by a second; and a comprehensive program of forestry eventuated. It embraced a program of action by the industries to protect mature timber and young growth, bring about restocking after logging, and extend widely selective logging and sustained-yield production; and also a program of public action, held necessary to support the undertaking of the industries. The public measures thus programmed included more cooperation with private owners for reducing fire and other hazards, enlarged public ownership, revised tax laws, expanded forest research, and long-term forest credits. All these involved legislation.

When the National Industrial Recovery Act was declared unconstitutional, the question arose for the forest industries whether to cease collective effort for conservative forest practices or to continue it, so far as was possible after the basis for enforcing measures of regulation had vanished. Seven regional lumber associations, representing 75 per cent of the national production, voted that their conservation work should go on as vigorously as a limitation to educational methods and voluntary observance would permit. The effort to establish good forest practices as part of their woods operations has been maintained by the industries to the present time, with a surprisingly small breakdown from the termination of the Lumber Code.

Meanwhile, there has also been in the field a Joint Committee, set up by the joint conference of representatives of public agencies and the forest industries which inaugurated the N.R.A. forestry program. It was the Executive Committee of the General Conference, charged by that Conference with continuing its work. Following the collapse of the N.R.A. this Committee canvassed the entire situation. It was convinced that the whole forward movement in national forestry initiated by the Recovery Act is basically sound, and should not be permitted to lapse; that the industries are showing a serious purpose and good faith in continuing the plan adopted by the Conference; and that the other essential features of the Conference program should be carried to fruition by federal legislation.

Many feel that the public action has not kept pace with the industrial. It is true that federal expenditures for cooperative protection and the acquisition of National Forests have been substantially increased temporarily, but this has been through allotments of emergency

funds, not through legislation which could be held expressive of a permanent national policy. In January, 1935, the President urged the respective states to enact appropriate laws for aiding the national program; and there has been a moderate response. The Fletcher Bill (S. 3417; H. R. 9197) is the fruit of a study of the peculiar credit needs of forest owners, conducted jointly by experts of the Forest Service and the Farm Credit Administration. The Fulmer Act, approved August 29, 1935, is important permanent legislation, designed to build up State Forests with federal aid. Aside from these proposals, only one of which has resulted in legislative enactment, and the enlarged activities of the Forest Service in promoting sustained yield methods of land management, there has been no permanent, affirmative action by the national government for carrying out the public measures advocated by the Conference.

The Joint Committee, convinced that a strong effort should now be made to hold the gains in forestry made under the Lumber Code, has drafted a proposal for new federal legislation, in the form of "A bill to promote sustained yield forest management." Its primary purpose is to extend the continuous or sustained production of timber as a commercial practice in the United States. Only those matters deemed most urgent from the standpoint of cooperative relationships between the federal government and states and private forest owners were included.

Sections 1 to 3 of the Bill broaden and strengthen the legislative basis for federal, state, and private cooperation in forest protection, including flood control. Provision for the continued study of forest taxation is retained. The appropriations authorized are required to provide the essential foundation of security from natural losses and hazards without which no sound structure of sustained forest production can be built.

Section 4 will aid directly in bringing about sustained yield management of commercial timberlands. It would authorize the Department of Agriculture to set up sustained yield units, comprising National Forest and private lands, under contract with forest owners to operate their holdings in accordance with the requirements of continuous production.

Section 5 is directed to the same purpose. It broadens the extension and promotive work of the Forest Service in cooperation with the states and forest owners.

Section 6, dealing with the national survey of forest resources, is included in this Bill of essentials because of the importance of adequate and current stock-taking and fact-finding as a basis for sound planning. Splendid progress already has been made, largely with emergency funds, and the partial results indicate the importance of early completion of this work.

Sections 7, 8, and 9 deal with the extension of National Forests. Aside from a desirable broadening of the present statutory bases for land exchange and land donation, a moderate program of forest purchase is authorized for the ensuing ten years. The purposes to be served by the National Forests are also broadened by including specifically the encouragement of continuous production and sustained yield operations by commercial forest owners.

In this recommendation the Committee has materially reduced the scale of public forest purchases previously regarded by the Conference as a necessary part of the national program. To stabilize forest values under the surplusage of timber liquidation in the West, to aid many other forest regions in restoring growing stocks and bringing cut-over areas back into productivity, and to serve the many other needs in land use which only public for-

ests can adequately satisfy, the Committee is convinced that this much federal acquisition during the coming decade is a vital part of the whole movement.

The Bill here proposed has been pared down to the most necessary items. Other meritorious proposals have been omitted, in order to concentrate upon outstandin needs. The Committee feels that it woul be a grave mistake to fail to enact in permanent forest legislation these co crete results of the past three years cooperative effort by the public and th forest-using industries.

Cutting for Sustained Yield

THE late William Willard Ashe was a pioneer in forestry in the South, and left a rich legacy of precepts and principles. One of his contributions, of outstanding importance to good forestry practice or management, is the doctrine of maintaining an ample forest capital, or growing stock, at all times. In his own words, published in a leading farm journal:

"The way in which timber is cut and the amount of growing wood continuously left upon the land in large measure determine the profit which comes from timberland. Not all of a stand of second-growth pine, even though most of the trees therein may be 12 inches and even more in diameter, should be regarded as the crop. Only a portion of the trees represents the *crop,* while the remainder represents a portion of the *capital* or growing stock and must be held and kept growing in order to secure this maximum yield which the soil is capable of producing.

"Bear this in mind and never lose sight of it—it is the basis of all methods of making timberland profitable: No matter how urgent the need, no matter how insistent the buyer, *hold upon the land a large part—at least half—of all the timber which in your mind the soil is capable of sustaining.* It would be far better could you hold two-thirds, but it is not always possible to hold this much in making a sale to a sawmill."

This is bed-rock doctrine for woodland owners.—W. R. Mattoon, *U. S. Forest Service.*

THE C.C.C. MOVEMENT AND ITS RELATION TO THE CLARKE-McNARY ACT

By C. S. COWAN

Washington Forest Fire Association

The development of the Civilian Conservation Corps has led to the official attitude that the fire suppression force thus provided takes the place heretofore occupied by protection men employed with the aid of Clarke-McNary funds. The writer contends that this policy is dangerous. It means that the organized and trained prevention forces are reduced, while Civilian Conservation Corps' effort increases the potential sources of fire risk. It is contended that the creation of the Civilian Conservation Corps should lead to a more intensive protection of the forest values created.

DISCUSSING the Civilian Conservation Corps accomplishments is a popular move, and I wish to add my meed of praise.

The C.C.C., its work, its accomplishments in the field, and more particularly its sociological benefits to the boys it has taken from idleness, have been eulogized so much and so often that whatever I may say here will not add very much. The three specific accomplishments already mentioned are splendid in themselves, more particularly when one realizes the tremendous difficulties which had to be overcome before some 400,000 men could be welded into a unit almost overnight.

The field work, so far as I can judge, has been of tremendous importance, and well done. Its contribution towards fire suppression is of immense value to the Nation as a whole. Its benefits to the boys themselves, physically and mentally, are I believe an asset in the health of the Nation. So far as I am personally concerned, through the means of personal contact and knowledge, I have nothing but praise for these accomplishments.

I do not intend, however, to allow this to blind me to what I personally believe are defects in general policy. My attitude is no secret. I have been somewhat outspoken in the matter, believing that constructive criticism is good for all of us, but more especially good for the other fellow.

We are asked to rely on the Three C's as the main line of defense in forest protection. Clarke-McNary fund allotments to the states have been reduced possibly $300,000. Clarke-McNary funds have been, under the terms of the grant itself, devoted to presuppression activities. Through this federal aid there has been built in the timber states, primarily at the insistence of the federal government, an organized protection force, used for those patrol and presuppression activities which throughout the years of organized effort have been looked upon as the main pillar of all forest conservation work.

We are now told that, in lieu of some $300,000 for the organization of a regular field force to prevent fires from starting or gaining headway, the government is willing to spend several hundred million dollars in placing the C.C.C. force at the disposal of forest protective agencies. The logic of this is not quite clear to me. It says in effect that the Three C force is in the field to create our road, trail, and telephone systems, erect bridges, plant denuded areas, and reduce fire hazards, and to fight fires as they may severally occur, but that it is not felt necessary to continue the organized, trained force for patrol and prevention of fires on the forested and reforesting areas we aim to protect. We are willing to lock the stable every time the horse is stolen. We are quite willing that inexperienced crews should undertake fire fighting as a side

line. This action would lead to the belief that the actual physical effort of suppressing fires is much more glorious than corraling incipient fires.

Yet the areas in need of intensive patrol are increasing, and much more through the work of the C.C.C. than any other single factor. The opening up of any territory to travel is the opening of that territory to fire risk. I believe that this road work is running somewhat ahead of present requirements. This is a forced condition, due to unemployment. But the fact remains that we are increasing fire risk as well as opening the means of patrol. One patrolman can only be in one place at a time; the firebugs can now spread out over a greater territory with greater ease. This is a condition protection men always face, but just now we are doing what would normally take many seasons' work, and this work would ordinarily be done by the protection crews.

A recent newspaper report of a speech made by a commanding general quoted him as stating that the Three C men in his camps cost $8 per day per man. Assuming that he had first-hand information, can it be said that we can possibly get the same return from the C.C.C. men for suppression work that we could get for a fraction of this amount spent to build and maintain an organized prevention force?

I am informed that almost a billion dollars has been expended in the Three C movement since March, 1933. No right-minded person would charge all of this vast sum to purely forestry work. That work was incidental to the sociological objectives, and I am not at all sure in my own mind as to exactly how I would charge the costs, as between these two separate functions. Knowing the conditions which existed in 1932 and 1933, I am quite prepared to charge off 60 per cent of this billion dollar expenditure to other than forestry objectives. This leaves the sum of four hundred million dollars chargeable to forestry, mainly, as I read reports of accomplishment, in the field of forest protection. The Copeland Report, a truly monumental tome, recommends that Clarke-McNary aid should be brought at least up to the authorization originally passed by the Congress, and in fact recommends that the Clarke-McNary allotment be increased to five million dollars. It believes that this sum will be the government's fair share of forest protection costs; a federal responsibility to its citizens. We will admit that when this recommendation was made the Three C movement had not been born and that the contribution made to fire fighting by this force was not therefore given any weight.

I wish to make clear that I highly value the efforts of the C.C.C. in fire suppression. But the business of fire suppression has always needed trained leaders. Where is this leadership to come from? We cannot expect that the C.C.C. will develop it out of its own experience in fighting fires; this is too costly in acreage and other values. We must have trained leaders available for all forest work. While the C.C.C. can and does act as a most powerful suppression unit, we are developing, at a rapid rate, those areas which need intensive protection and patrol. The C.C.C. man-effort is bound to be somewhat nullified by lack of experienced fire leadership. At present this leadership is supplied by the forest protection agencies, but it is woefully lacking in numbers. Local men do not require the supervision necessary for the C.C.C.—which is in no way a reflection upon the untrained men.

These further facts must be considered, and having been considered, must be given full weight. Every mile of road, every mile of trail is a potential hazard as well as a means of protection. We can get to more places in a shorter time than we could before; but so can the public.

We place locked iron gates on our protection roads, and the public breaks the locks, pulls out gates, demands that publicly constructed roads be made available for public use. It is true that only a small percentage of the public makes these demands. It is just as true that an even smaller percentage of our citizens are responsible for our fires. But the fact remains that we have fires, and that these fires are caused by the same general public. It seems to me it is high time that the public be made to realize that we will never have real forest protection until public authority gives the same measure of fire protection effort the forest land owner and operator has given. If it were not for public carelessness, we could reduce Clarke-McNary and all other forest protection expenditures. We have not yet secured even a fair measure of public cooperation in this matter, yet we go on opening up the means of access to the timbered areas. And as we go, expending prodigally in time, effort, and money, by reducing Clarke-McNary presuppression allotments we fail to protect the investment we have made. In substituting suppression for prevention effort, we are prostituting forestry.

Now, just a few words as to the control of the Three C camps. First let me read you some of the most hopeful and inspiring words that I have read in years.

"To meet its responsibilities, a state forestry organization must have permanence, stability, authority, and *freedom from political interference.* Its staff must be composed largely of technically trained men of high ability and sincerity of purpose. Lacking these essentials, it will inevitably fail to achieve the objectives for which it should strive."

These words are to be found on page 1601 of the Copeland Report. They were written to try to correct conditions in some states, but were largely designed to formulate a sound fundamental principle upon which to build a forest structure. Now remember this gratuitous advice, and think of approved congressional lists, certificates of primary registration, and letters of recommendation from precinct committeemen as necessary qualifications for C.C.C. leadership.

I am fully aware of how your minds and souls react to these moves, but there the condition is. Can we really expect anything more than the hope of a temporary organization when such steps are deemed essential to build up a Three C force?

Let me leave this subject as it is—what more could I add other than words?

But there is yet another angle to be brought to attention, and this relates only to Washington, for there my definite information ends. In our state, roughly about 25 per cent of the total area is in National Forest. This is not a generally traveled territory. It is not the high risk area which exists without the National Forest boundaries. It has not the timber values, the replacement possibilities to communities and to industry, nor has it the fish and game attractions which exist on private lands. On these points there can be no argument.

Now let us see what weight these points carry. During the summers of 1933, 1934, and 1935 there were 75 camps established in National Forest territory; there were 26 on state and private lands. Approximately 75 per cent of the man power to protect 25 per cent of the territory, even leaving out of the question the difference in fire risk and values. Even during the winter months the National Forests operated 47 camps, as against 37 on state and private lands.

One answer is always made by federal officers: We are spending public money, it should be spent on public property. The money is not "public money" produced from a magician's hat. It is taken from the taxpayer. Surely he is entitled to a full measure of protection. Still further, such public money should be right-

fully spent on controlling the public hazard. It is upon this control of the public that forestry ultimately depends.

Now for another figure by way of proof. In National Forest territory in Washington during the 1935 summer enrollment period there were expended 64,164 fire fighting man-days. Who was responsible for the vast proportion of these fires? Surely not the logger, who does not operate to any extent upon National Forest territory. It was the camper, the recreationist—the public, if Forest Service records are reliable. To an even greater extent, the general public is traveling on state and private lands. Are not state and private forest lands entitled, in every sense of the word, to at least the same measure of protection as the National Forests? There has been a very natural selfishness in allotting C.C.C. units. This is totally foreign to the splendid phrases publicly printed at public expense in the Copeland Report, which, I will remind you, is entitled "A National Plan for American Forestry."

Now as to future use of these roads. In state and private territory every effort has been made to so locate road improvements that they lead through or traverse cut-over forest lands which are worthy of intensive protection. On all roads, an iron gate is placed to prevent general travel. The land itself, however, is always subject to sale. A forty sold here and there, and access must be granted to the new owner. The public generally finds it difficult to understand forest protection roads. It argues, understandably, that if public money builds a road open to travel in one territory, then all publicly built roads should be open to travel. How can one road be open legally, and another legally closed?

The roads open vast areas to salvage operations of cedar posts, poles, fence posts, cordwood, etc. The attitude of some land owners is that such values are a major inducement in selection of land purchases. But roads open these area to promiscuous acquisition of such prop erty, without the formality of acquirin title. Difficulties with the public of thi type are not general at present, but it i going to present a difficult problem in some localities.

The road problem has always been on of dispute—to open, or not to open. think that I am safe in saying that west ern Washington has planned its C.C.C road system well, and it can expect minimum of trouble from this source Hunters and fishermen have, I understand hitherto been the sore spots in the pic ture. I believe that the sportsmen of ou state are showing a vast improvement in their attitude towards forestry in gen eral, and that friction from this source will decrease as understanding grows.

I come back to this, that it is my con sidered opinion that the reduction in Clarke-McNary allotments will do more to discredit forest endeavor than any other single action. The spending of millions of dollars for suppression, the reduction of thousands for prevention, does not make sense. But that is what we are doing just now. Look at the C.C.C. movement for what it really aims to do. As I see it, its sociological benefits must come from the application of a sound, progressive work plan, aimed at definitely accomplishing a definite forestry objective. It is this which elevates it so far above the leaf-raking and boondoggling movements which were set in motion as a substitute for relief payments. The C.C.C. movement is good in itself, and it is good in suppression value, but it cannot be expected to take the place of a trained and organized prevention force. The present situation is fraught with danger. Can anyone expect politically appointed leaders to be capable of rendering that degree of service and effectiveness that the Copeland Report so beautifully states is necessary if forestry objectives are to be achieved? Or is forestry

merely something to be practiced on National Forest areas only?

The National Plan for American Forestry states that the basic needs may be summarized, among other points, as "annual appropriations for annual carrying charges to provide capable executives, trained personnel, equipment, and labor for suppressing fires." This is what the private owner is doing. The federal government preaches, "Do as I say, not as I do."

The Copeland Report agrees in principle that there is a very great public fire risk; it specifically states that hunters, fishermen, and recreationists generally are responsible for approximately one-third of the annual fires in these United States. It ignores the fact which we in the West face every year, that we have an annual crop of fires and fire expense caused by the tenant of that type of land called "stump ranches." In western Washington this expense amounts to over 25 per cent of the annual fire bill. This is indeed a public risk, and must be faced. The private timber land owner has set up his protective organizations, he is called upon annually to foot a larger share of the fire bill which is charged up by the public. He has provided the most modern and progressive systems of fire fighting, while the federal government is reducing its contribution to the cost of maintaining that force it states is essential to forestry.

The C.C.C. is in being, it is doing a great work, both for the boys and for forestry. It is, however, doing that forest work which should be incidental to the field forces of protective organizations. A trained force, a local force with an abiding interest in its own problems, a continuing delight in its accomplishments, is necessary. Be honest, think clearly and straight, and state how much of the C.C.C. program would *you* have authorized if *you* had an unlimited budget? Then allow for the times, and rate the work at its true value, which I am most decidedly not minimizing. But neither will I concede that all such work should masquerade under the title of forestry. The C.C.C. can rightfully take sufficient credit for its work and its aims, but I do not confuse these.

When this period passes, as I trust it soon will, we cannot expect young, healthy, ambitious youths to enter willingly an organization of this kind. If we continue as we are doing, we run the risk of losing our trained men, we are throwing them overboard for youngsters who have no permanent interest in the forest problem, and most certainly not the interest which local men, locally trained, have in their problem. The forest picture is a whole, but it must depend upon local viewpoints, local competition to do the right thing, local endeavor to keep down fires and save acreage. This local competition is healthy, and it builds up the several parts which complete the picture. Local men, with a local knowledge of country, weather conditions, trails, roads, timber species, and more particularly the local population, fit in with organized effort. We cannot push forestry and drop our trained local men at the same time.

Mr. Black foresaw this last year, he forcibly pointed out the danger, and unfortunately he was a true prophet. Splendid as is the C.C.C. in concept, it is still not the force which can take the place of properly trained local men organized for permanent protection control. The C.C.C. was not organized with this in mind. No one would logically organize 400,000 men permanently in order to take the place of possibly 3,000 or 4,000 men normally employed with Clarke-McNary funds. We are dealing with a temporary organization, and it is obviously dangerous to break down the foundation upon which a true forest structure must rise.

FORESTERS UNDER FIRE IN E.C.W.

By H. B. MORSE

E.C.W. Inspector, Atlanta, Ga.

CONSIDER the following remarks, and think of them as made by a forester who is decidedly interested in seeing the C.C.C. camps made productive, efficient working units, by foresters who are mentally active in gaining this end.

They are made by a forester who graduated from Biltmore Forest School in 1907; has since been in the employ of private wood using industries in forestry activities, with no governmental work of any character up to May, 1933; was a Project Superintendent from May to October, 1933; has from then to date been an E.C.W. Inspector, largely in the eleven southeastern states; and was during that time spending from one to two days inspecting each of about 200 C.C.C. camps.

The Society Meeting in Atlanta brought forth remarks that tended to show that E.C.W. expenses on work projects were excessive, and that foresters were going through a process of degeneration as the result of economics not being sufficiently stressed.

The two may at a glance appear to be separate items, but when we become aware of the fact that much of the work being done is in charge of foresters, the two become closely allied.

It cannot be questioned that the expense is excessive in many cases. The charge of "degeneration" can, however, be argued.

Inasmuch as a considerable proportion of such work is immediately in charge of foresters, it behooves them, as individuals and as a body, to lay plans for improvement if for no other reason than that they may be able to prove, when charged with inefficiency, that they have done everything possible to improve conditions.

How can such improved plans be put into effect?

Let us first go back to the reasons for these camps. We discover that they were primarily for young men of from 18 to 25 years of age, who had nothing better to do than hang around street corners where they had nothing else to do but get into trouble. They were too young to have learned a trade, or to have had any business training. They were raw material. Their environment had a great effect on their viewpoint of life. They had never done much work. They were taken to these camps and then handed over to the Using Services, to work on various projects. From then on is what we as foresters are interested in.

It was distinctly understood that they were to be turned back when their enrollment ended, better if possible than we received them, with the idea implanted in them what real work means. What better way can they learn this than by handling all work efficiently?

We had all kinds of work for them to do, from girdling trees in timber-stand improvement work, through all the labor on road work, including the operation of road machinery, to the lonely job of lookout in some observation tower.

What have we done to and for them, to enable them to learn what *work* means; to make of them efficient cogs in the organization and production of the work projects?

We have done considerable, in a crude way, on every job. Many enrollees who have showed a desire and aptitude for leadership have been picked out and

promoted to positions among the camp supervisory personnel. However, let us not pat ourselves on the back for this, as it had nothing to do with our own initiative, but rather was due to inherent tendencies and desires of the enrollee, that made it necessary for him to do something more than just what was asked of him. He actually built himself up, and forced himself on us.

In all this work we find that there is a unit of control. It is the Rated Man, with his crew of from two to twenty enrollees. Also it is a fact that each project can be broken down into component parts, each of which is easily understandable by any such Rated Man if he is worth the additional pay he receives.

The titles these rated men are given are Leaders and Assistant Leaders. "Leadership" is doubtless an inherited quality to a large extent. It means, with this class of labor, an ability to get the work done by leading and not driving, and perhaps needs a sounder background of knowledge for this work than elsewhere, owing to the fact that the enrollees have to be shown how to use efficiently tools they never before handled. Leadership in these camps must be such that each enrollee puts out a full day's work in an efficient manner, and that such work conforms to set standards, with neither too much nor too little time spent on any one part.

What are you doing to train these rated men to make them the efficient leaders that they have to be?

Knowledge of the standards and plans of each project must be in the minds of all supervisory personnel and rated men, in order that they can intelligently direct the work.

What are you doing to train the supervisory camp personnel and rated men to understand clearly the standards set for the project work?

Ability of the worker to handle efficiently his tools is the one big feature that makes possible the successful completion of the work project.

Did you ever watch a man work who really knew how—shovel dirt; rake a lawn; grind an ax; drag a crosscut saw; wield an ax; drive a truck; operate a road grader; break rock with a sledge; drive a tractor trail-builder; operate a bolt riveter in steel construction, or any other detailed labor operation? If you have, you will know at once what a real efficient machine each is in his own line, and if you try the same thing yourself you will learn that you will have to work for some time before you can even approach his efficiency.

Do you realize how much of the success of the project depends upon the efficiency of these individual workers?

What, if anything, are you doing to improve the ability of the enrollee worker to handle his tools and to train the supervisory personnel and rated men to properly supervise and instruct the enrollee in such activities?

Is it possible that you are doing something that previous to the E.C.W. you would never have thought of doing? Are you expecting results from a class of labor that is untrained? Are you using supervisory personnel that is likewise untrained?

In your timber-stand improvement work and your planting you spend considerable time training your crews—why not be as intensive in your road work, which today is a large part of your work load?

What are you doing for plans that will make each project an efficiently handled affair? Has the Project Superintendent a set of specifications for each project? Has he been given the task of completing it with the use of a certain specified number of man-days, number of machine-hours, number of truck-days, and a time limit within which it shall be completed? Has he such a thing as a workload for the month, that he is responsible

for getting done and which he allocates to his foremen and rated men? Is each day's work a certain part of that month's work-load, and thus a task for this supervisory force to see completed? (Which results in their being forced to always be thinking on the job.) Do you consider it a part of your prescribed duty to inspect sufficiently frequently to check on the progress of the work, and assist the Project Superintendent in every way possible to reach his goal, as well as to see that the standards as set are being followed?

Are you so planning personnel activities that you are building up your camp organizations from within, by proper training activities?

Are you planning your work projects for each camp so that, practically regardless of weather conditions, you have available projects that can be worked on every workable day?

Do your plans call for "continuity" on your road projects?

In other words, are you planning your work so that it is being laid out efficiently, with supervisory personnel in charge who are held to the responsibility of completing it within set limits, and who in turn are training their foremen and rated men to take charge of crews that in turn are turning out the work-load laid down for the camp?

Foresters are today being given an opportunity that should be grasped in order that the E.C.W. will be efficiently carried on, and so carried on that, when they are questioned concerning their part in it, they will be able to show they have given thought to all its phases, and can show for it all an efficiently managed organization.

If things go wrong; if costs remain excessive; if personnel remain inefficient and lacking in interest; if enrollees are not producing; don't go elsewhere to place the blame; don't destructively criticize the whole E.C.W. movement—just look under your own hat and find out why the gray matter *there* is not properly functioning. These camps are here now, and may remain for some time to come. Why not make the most of their labor, by efficiently planning their operations? You will never again have such an opportunity of showing your administrative and management ability.

Every once in awhile, get away from your detailed problems and climb up where you can get a perspective of the entire job, and from that point of vantage discover the weak spots that need strengthening.

FOREST INFLUENCES AND EROSION CONTROL[1]

CONSERVATION of soil, and with it water resources, has received public attention as never before. While the focus of attention is for the moment on farm lands, it applies with equal force to grazing and to forest lands. Accordingly those who have worked for conservation of basic resources for the past generation may be heartened by the turn of events in the past three years. It is said tragedy purifies the emotions; equally may it be said that adversity clarifies our thinking. Out of the depression is emerging clearer thinking about our soil, water, and forest resources than has yet occurred. While many problems remain yet to be worked out, it is gratifying to report to the thirty-fifth annual meeting of the Society of American Foresters, that we as a nation are standing on the threshold of a new era in the relationship of the American people to their land, water, and vegetal resources.

For a period of three centuries, from the time the English colonists first cleared away pine trees on the Virginia shore for building houses and for planting patches of virgin soil to Indian corn, the American people have been busy occupying the wide expanse of continental United States. The frontier of new land that was progressively pushed westward has disappeared; it is gone. But there has appeared underfoot a new frontier—the conservation and wise use of land resources. We are advancing on a new frontier, which calls for courage, energy, clear thinking, and constructive action to a degree equal to if not greater than that manifested by the frontiersmen in their conquest of the West.

Some Significant Events of the Past Year

1. The promises for eventual sustained yield management of private forests of the Nation in Article X of the Timber Code were blighted, for the time at least, in the action of the Supreme Court in declaring the N.R.A. unconstitutional. A discussion of the situation of forest utilization has been presented to this convention by Mr. B. F. Heintzleman.

2. The passage of the Fulmer Act by the first session of the Seventy-fourth Congress provides for federal assistance to the states in the acquisition of forest lands for State Forests. This act is looked to for retaining in and restoring to forest cover lands that require such protection in the interests of the conservation of soil and water resources. If this act had also included provisions for similar aid in the establishment of community or association forests, it is believed that a more complete solution of the conservation of soil and water resources to local communities would have been effected. Such extension of the law would aid in the solution of land use problems, especially in the southern states.

3. After 30 years of apparently fruitless agitation on the part of various agencies and individuals, the problem of the public domain in the western grazing states is being met with definite action. By February it is expected that approximately 80 million acres of the public range, formerly open to all comers, will have been set aside into grazing districts under the provisions of the Taylor Grazing Act. This is a significant step. It is expected that measures of range management will be worked out in due time which will provide for revegetation and the protection of western watersheds from headlong erosion processes. Supplementary action in authorizing the inclusion of the remaining public domain lands suited to administration under grazing districts is required to complete the work thus far begun. It is a measure much to be de-

[1]A Society committee report.

sired for soil and water and range conservation in the West.

4. The transfer of the Soil Erosion Service from the Department of the Interior to the Department of Agriculture in March, 1935, served to consolidate related activities in erosion control within one Department.

5. On April 27, 1935, the Soil Conservation Act became a law. This measure is a landmark in conservation in the United States. Under this act the Congress recognizes that the wastage of soil and moisture resources on farm, grazing, and forest lands of the Nation, resulting from soil erosion, is a menace to the national welfare, and that it is hereby declared to be the policy of Congress to provide permanently for the control and prevention of soil erosion and thereby to preserve natural resources, control floods, prevent impairment of reservoirs and maintain the navigability of rivers and harbors, protect public health and public lands, and relieve unemployment, and the Secretary of Agriculture, from now on, shall coordinate and direct all activities with relation to soil erosion.

What would George Marsh, N. S. Shaler, L. H. Bailey, Fernow, and other early pioneers in the conservation of soil resources of the Nation say to this act? We hope they would be gratified. It may be said that this act is the fruition of the work and studies of a courageous group throughout the country, who have envisaged the time when the utilization of renewable resources would be guided by principles of safe and sustained use for the present and for the future.

The Civilian Conservation Corps

It is not the function of this committee to report on the Civilian Conservation Corps, which is being done at this convention. The C.C.C. has played such an important part in advancing the work, thought, and practice in soil, water, and forest conservation that no report on conservation would be complete without special reference to it. So fully have we been occupied with the details of putting men to work that the significance and implications of this new institution in our social order have escaped most of us. The direction of a half million of young men to works of conserving soils, waters, and forest has implanted in the minds of the people of this country concepts and convictions which might have taken a generation or more to accomplish.

The Civilian Conservation Corps has made possible to agencies engaged in conservation accomplishments what would otherwise have been long delayed. This Corps deserves to become a permanent fixture in our social order, to continue to be an agency for the conservation of human and material resources of the Nation.

Work of the Committee

It is reported with regret that the chairman and members of subcommittees on Terminology, Survey of Erosion, Experimental Work in Forest Influences and Erosion, Erosion Control Work in Progress, and Appraisal of Erosion Control in Foreign Countries, have not completed detailed reports on these phases of the assignments to this Committee. Accordingly only a partial report can now be made.

It is expected that a report on the revision of terminology will be prepared within the year by Dr. Hursh's subcommittee.

Survey of Erosion and the Silting of Streams and Reservoirs

Since the report of national erosion and forest surveys in last year's report, a significant work has been carried out by the Division of Research of the Soil Conservation Service in the silt surveys of important reservoirs. Detailed surveys

have been completed on 22 reservoirs. The survey is continuing to other important reservoirs of the Nation.

In this connection it will be interesting to the Society to know that a map is being made of the Boulder Reservoir, to a scale of 1,000 feet to the inch and with contours on 10-foot intervals. Only by aerial photography could this job have been done in time to establish an accurate map of the area before submergence by the lake. The contours are being drawn in by the aerial cartograph machine, which assures greater accuracy than could possibly have been attained by ground surveys. Controls of first order accuracy were supplied by the cooperation of the Coast and Geodetic Survey from its surveys to determine the possible effect of weight of the lake upon warping of the earth's crust.

The specifications called for 5-foot contours on the valley floors. This objective was accomplished by aerial-photographing the lake at 20-foot rise intervals as gaged at the Boulder Dam. Thus water-marked contours were established whereby the 5-foot contours were accurately interpolated. It was necessary further to put a party of 12 men with 4 special boats down the canyon for 45 days to sound the river for cross sections and for a traverse.

This map will serve as a base for comparison of subsequent repeat silt surveys by sounding throughout the life of the reservoir. The rate of silting of the reservoir may thus be determined from time to time, and serve to indicate the need of measures in the drainage above the dam.

Survey of Experimental Work

The survey of experimental work is incomplete. Workers in research have not had time to report the amount and extent of research work under way. It may be added, however, that the San Dimas Experimental Forest, which the chairman initiated as a watershed study, is now nearing completion. A program of watershed studies on agricultural lands being carried out by the Division of Research of the Soil Conservation Service is now under way. Work is in progress on the Coshocton Watershed Study in Ohio, lying within the Muskingum Conservancy District. A similar study is being initiated in the Brazos drainage of Texas.

A survey of erosion control work now in progress is not yet ready. Such a survey of work done by the Civilian Conservation Corps is being made and need not be repeated here.

Erosion Control in Foreign Countries

The Chairman of your committee presented a paper entitled "Erosion and its Control in the United States" before the Third International Soil Science Congress, held in Oxford, England, last summer. Interest in erosion was actively expressed by soil scientists from British East Africa, Nigeria, South Africa, Italy, Ceylon, India, China, and from Australia. Soil erosion is not a serious problem except locally in central and northern Europe, where rainfall is gentle and steep slopes are retained in pasture and forests.

A National Program in Forest Influences and Erosion Control

Waters necessary to municipal, irrigation, and other uses, as well as flood waters, drain from lands under various types of usage. Agricultural operations may have important effects on the regimen of streams. The same is true, perhaps to a somewhat lesser extent, yet to an important degree, of forest areas. The full use and control of water resources must eventually be based upon a body of information founded upon well planned and thoroughly conducted watershed studies. The Forest Service should be

looked to for a series of such studies affecting the forested areas of the United States, and the Soil Conservation Service for similar action on the agricultural areas. The programs in research by the two governmental agencies in cooperation with states and conservancy districts are expected to supplement each other, that information applicable to the entire Nation may be fully and accurately established.

Recommendations to the Society

1. That a resolution be passed to favor the continued support of forest influence studies by the Forest Service, and erosion and flood control studies by the Soil Conservation Service, for selected drainage areas, with special reference to the role of native vegetation and of land use practices in erosion control and in streamflow, and further, that this program of studies by the Forest Service and the Soil Conservation Service and cooperative agencies be fully correlated to meet the needs of such information for planning in the conservation of water resources and in flood control.

W. C. Lowdermilk,
Chairman.

Editor's note—The above report of the Society Committee on Forest Influences and Erosion Control was prepared for submittal at the Atlanta Annual Meeting but was not presented and was therefore not included in the Proceedings published in the March Journal.

Susceptibility of the Southern Pines to Wind Damage

After a recent high wind, the following observations were made in 3- to 5-year old mixed plantings of the important southern pines at Clemson College, in the upper Piedmont of South Carolina. The longleaf and shortleaf pine appeared to be unaffected by the wind. With the exception of one tree that was slightly loosened in the ground, the loblolly pine was not noticeably affected. A large number of the slash pines, however, were severely bowed by the wind and in places many trees were considerably loosened in the ground and were inclined appreciably from the vertical. Among the trees 8 to 10 years old and 20 feet or more high, it was found that three slash pines had been blown down. Loblolly, shortleaf, and longleaf pine of the same size in the immediate vicinity of these fallen trees showed no loosening effect whatsoever. At the time of the wind the ground was thoroughly water-soaked and in a condition that would make wind damage to trees more probable than usual. Although in no sense conclusive, in this locality slash pine would seem to be more susceptible to wind damage than the other important southern pines.—R. A. Cockrell, *Clemson Agricultural College.*

THE PLACE OF FORESTRY IN THE NONPROFESSIONAL SCHOOL

By R. P. HOLDSWORTH

Massachusetts State College

The author of this paper maintains that in the broad scheme of forestry education in the United States there is decidedly a place for nonprofessional forestry instruction as a part of the undergraduate college curriculum. Numerous colleges are giving such instruction. The work done at Massachusetts State College illustrates the field to be occupied and the objectives to be aimed at. One important part of the field is the laying of a good foundation for later professional education elsewhere, through a preparatory college course of preprofessional study. The general character of the courses of instruction offered is briefly outlined.

THE professional forestry schools of the United States have been studied critically by a committee of the Society of American Foresters. This study was limited to those institutions offering curricula in forestry designed to provide rather complete courses in instruction and training for the profession of forestry. Not included within the scope of the study were the numerous colleges that offer instruction in forestry on a nonprofessional basis.

These nonprofessional schools (so called for lack of a better designation) play a role of real and increasing importance in the field of general forest education—a role that is sometimes assessed at less than its full possibilities for service to forestry even by those most closely concerned with it. Such schools may assume, with all modesty, that their accomplishments in forestry are not overshadowed by the achievements of the professional institutions. On the contrary, their contributions to general forestry may well justify the assumption by the nonprofessional schools of a proud and positive place in the field of forest education. Theirs is a position where the designation "nonprofessional" need not carry the slightest implication of inferiority.

Maintaining close contact with the public—and this is especially true of the land grant colleges—these schools are in a position to exert a strong and growing influence in forest appreciation, in the field of general forest education, and in bringing about the application of forestry on the land. This position is so rich in opportunity for effective accomplishment, and so many and varied are the problems involved, that an attempt to set forth the place of forestry in the nonprofessional school seems to be definitely worth while. It is a fertile field that should be cultivated to its full capacity.

The writer takes it upon himself to summarize as a "case study" the forestry situation at Massachusetts State College, an institution that is developing its work in this field on a nonprofessional basis.

Our program is arranged in harmony with the broad functions of the College, which are: (1) resident instruction in various fields of learning, (2) leadership in a statewide extension program of adult education, and (3) provision of appropriate programs of investigation and research.

The work of resident instruction in forestry is of primary importance, and has been arranged for the purpose of meeting the requirements of considerable numbers of students of diverse interests. These students, classified as to their forestry needs, may be separated into four rather clearly defined groups, as follows:

1. Those who plan to go back to the land, and who therefore desire some very definite knowledge of the principles of forestry which they later plan to ap-

ply in connection with varying programs of land use. This group (which includes students in the Stockbridge School of Agriculture, a two-year vocational school separate from but located on the campus of Massachusetts State College) requires instruction in applied forestry. These men are proving to be of real value in demonstrating and advancing the practice of forestry on the small woodlands which in the aggregate compose so large a part of our forest area. These men acquire a general understanding of the principles of forestry, its aims and objectives. They are receptive to instruction, and are likely to become active practitioners of forestry in a small way in dozens of locations throughout the state. The cause of forestry must be supported by the public, and it is such men, who have definite knowledge of its aims, principles, and methods, who will furnish much of the intelligent support that is needed. Thirty or more men each year take the forestry courses with the idea of future application in mind.

2. Another group of students is composed of men who are following major college courses that in one way or another have certain definite relationships to the field of forestry. They are not particularly interested in forestry for its own sake, but they recognize it as an auxiliary or supporting subject to their chosen line of study. For example, Massachusetts State College offers particularly strong undergraduate and graduate work in entomology that attracts each year students in considerable numbers. For several years past, one or more courses in forestry have been advised for certain of these men. The response has been so satisfactory that the department of forestry is cooperating further by scheduling a section in which an effort will be made to present certain aspects of silviculture from the viewpoint of these entomology majors.

Other college departments recommend courses in forestry to their major students. Among these are Agriculture, Economics and Landscape Architecture. It seems fairly obvious that not only in these fields of study but in several others forestry furnishes valuable complementary knowledge. It is quite possible that the teaching of forestry in a nonprofessional school could be entirely justified for its value as a supporting subject alone. This phase of forestry instruction should be closely studied, for it is capable of much development.

3. A third group of students is composed of those doing graduate work. No major work in forestry is offered to these men, but several minor courses are available. These are presented as individual problems, and for the most part involve no formal classroom instruction. The student and the instructor with whom he works maintain a schedule of conferences and field periods. Here again is an opportunity well worth cultivating. During the past four years a number of graduate students have taken these minor courses in forestry. The quality of their work has provided ample justification for the giving of the courses. Such individual studies have been undertaken as "The farm forest and its relation to the cultivated acres" and "A study of the reproduction of white pine in selectively cut areas." Opportunities for development in instruction of this kind are almost unlimited, and the values that accrue from it must be credited not only to the student who takes it but also to the instructor who participates with him.

4. The fourth group is composed of students who look forward to a career in forestry and who expect their state college to help them attain it. At first thought it would seem that these men, appearing in increasing numbers during the past two years, might offer a serious problem to the department of forestry in a nonprofessional school. Such, however, is not the case. The college is prepared

to help this important group of students without in any way altering its status as a school offering nonprofessional courses in forestry. Our position in this regard is based on two major premises: (a) That there are now in existence a sufficient number of long established and well equipped professional schools of forestry to supply the requirements of the country for trained foresters, and (b) that the growing importance of forestry indicates that in increasing degree it will properly become a subject for graduate study after a sound foundation has been built for it on a broad undergraduate curriculum in basic scientific and cultural subjects.

Massachusetts State College now offers a number of preprofessional curricula among which are the premedical and prelaw courses. For those students who look forward to a professional training in forestry, a preforestry course is offered.

The situation is explained as thoroughly as possible to these inquiring career students, and most of them accept the idea of a preforestry course as readily as they would accept the premedical or prelaw plan if either field was the one they were seeking to enter. For these men the members of the department staff act as course advisers, and assistance is given in the selection and scheduling of scientific and cultural courses basic to the training of a forester. In these schedules usually one, but sometimes as many as three courses in forestry are included, but the career student understands that these are primarily intended to be explanatory and descriptive of the field of forestry and that he will not receive professional credit for them in a graduate school of forestry. It is further explained that certain students of outstanding scholarship may be recommended for entrance to a graduate school at the close of the third year at Massachusetts State College, and that they will be granted the Bachelor's degree by the College on the creditable completion of the first year at the school of forestry. A few students proceed with this plan in mind, while others, especially some who are obliged by circumstances to be largely self supporting while in college, prefer to complete four years at the State College. Both plans are now in successful operation.

A preprofessional course of this kind has much to recommend it. In the first place, it provides a broad training for the undergraduate, one which seems to prepare him satisfactorily for the pursuit of technical studies in forestry. If, as sometimes occurs, the student relinquishes the idea of a professional career in forestry in favor of some other line of endeavor, he has not lost time in accumulating technical credits in forestry that he would willingly replace, if he could, with credits in other work.

In addition to the formal class and field work in forestry which career students include in their schedules, an effort to foster genuine interest in the subject is made by the instructors through personal meetings with preforestry students and the offering of certain extracurricular activities. These contacts are not pressed, however, and the painting of roseate pictures is strictly avoided.

Thus the nonprofessional school provides an avenue leading to the professional training that is desired by the declared career student.

The courses in forestry offered to students at a nonprofessional school must meet the requirements of a number of groups. They must be broad enough to be explanatory and descriptive of the general field, and yet be specific enough in their content to be of value when it comes to the application of certain principles on the ground. Two of the general courses offered at Massachusetts State College are built around actual field problems. The course offered during the first semester is based on the making of a forest inventory of an area of 40 to 50 acres. As the field work

progresses a map is made on which the forest type lines are located, and sufficient numbers of sample areas are estimated so that the timber volume can be determined. The class periods are devoted to discussions of the principles and methods involved. This plan of instruction, involving four hours of field and laboratory work and one hour of discussion each week, seems to serve its purpose very well. It has the advantage of setting a real problem, of making each step in the field work count toward its solution, and of offering a rather interesting and analytical introduction to the forest itself.

The work of the second semester is based on the practice of silviculture, and whenever practicable the field work is carried out on the same area where the inventory was made. Particular stress is laid in this course on the theory and application of the intermediate cuttings in relation to New England woodlands.

Tests are used in both of the above described courses, and emphasis is placed both on theory and field practice.

For the second semester a three-hour lecture course in forest economics is regularly offered, as well as a special course for graduate students in the Department of Landscape Architecture.

In the case of students of the Stockbridge School of Agriculture, mentioned previously, separate and distinct courses are given, with their particular vocational point of view in mind.

In presenting the field courses the 755-acre forest owned by Massachusetts State College is used to great advantage. This forest is also used to a considerable extent by other departments of the College giving instruction in the natural sciences.

The importance of a comprehensive program of extension work conducted as an integral part of forest education at a school of this kind is so generally appreciated and understood as to require little discussion here. The constant flow from the College of students who have ha some training in the field of forestry a crues to the advantage of the extensio program, which has as its chief aim th increased practical application of fo estry in Massachusetts woodlands.

Any program of forest research carrie forward in a nonprofessional school wi probably be modest in extent and pu pose. Nevertheless, the justification fo such work is ample. The forestry d partment not only may carry on work o its own, but may also act in collaboratio with other college departments and uni of the experiment station. Further, may find a real place as cooperator in in vestigative work with various divisions o the state Department of Conservation an the U. S. Forest Service. At Massachu setts State College this work is still i its beginning; but a number of projec are under way, which have an added valu in their interest to students and profes sional opportunity for staff workers.

The present department staff include three graduate foresters, as teaching mem bers, an extension specialist in forestry and a recently appointed professor o wildlife management—a new departur to meet a need that is becoming mor evident as the field of forestry become more comprehensive.

Undoubtedly nonprofessional school must develop their programs to fit loca conditions and requirements. What i done at Massachusetts State College ma not apply exactly elsewhere. The write has long remembered a bit of philosoph acquired from a sage Virginia friend o his Forest Service days: Do the best yo can with what you've got, where you are If that homely philosophy is applie those responsible at their several school for the conduct of nonprofessional forestr education will find so much satisfactio in cultivating their own rich fields tha any latent temptation to "go professional will likely be forgotten, never to be r called.

AMOUNT AND DISTRIBUTION OF MOISTURE IN A LIVING SHORTLEAF PINE

By B. J. HUCKENPAHLER[1]

THE amount of moisture present in the wood of trees is of much interest to scientists in the fields of wood utilization, forest entomology, forest pathology, and tree physiology. In the course of entomological investigations on the southern pine beetle a more detailed knowledge of the moisture and its distribution throughout the tree was desired. The data for this work were collected by the author and R. W. Caird at the Appalachian Forest Experiment Station, Asheville, North Carolina, during the late summer of 1930.

Procedure

The trees were chosen from a thrifty even-aged stand of shortleaf pine, an attempt being made to secure trees of about 6½ inches d.b.h. and 30 feet in height, with well formed crowns. The following information concerning each tree was recorded: Date felled, time of day felled, weather conditions at time of felling, d.b.h., total height, crown class, rate of growth, the time of the day through which the samples were collected, and the conditions at the time the samples were cut.

Samples were taken from 9 trees, each treated in the following manner:

After felling a tree, a short length was cut off to obtain a square cut and remove any chance of error due to drying between the time of felling and sampling. An entire cross section of the bole was then cut off, the outer bark removed, the inner bark or phloem carefully peeled off and immediately put in a paper bag of known oven-dry weight, and the sample weighed. The remaining section was also weighed and labeled the cross section. Another cross section was then cut off directly above, and the bark and phloem were removed and discarded. With a sharp knife the last two years of growth, the 1929 spring wood and summer wood and the 1930 spring wood and whatever summer wood was formed, were carefully chipped off and weighed. From the same piece the next 3 rings, including the spring wood and summer wood of the 1926, 1927, and 1928 years' growth, were similarly chipped off the circumference and weighed. The remaining portion was weighed and designated as the center. These samples were taken at 3-foot intervals up the tree until the diameter became so small that it was impossible to use the sections for other than the cross section sample. An effort was made to obtain a sample of approximately 25 grams of phloem and 50 grams of each of the outer 2 rings and the next 3 rings. The centers and cross sections varied considerably in weight, ranging from 200 grams at the base to less than 50 at the top of the tree. The larger center sections were split to insure complete drying in the time it took the samples in the bags to reach their oven-dry weight. After completing each tree, the samples were immediately partially dried to prevent the action of possible fungi.

The samples were dried in a Sargent water-jacketed oven in which the temperature varied from 100 to 110°C. Repeated weighings were made of representative

[1]Formerly with the Division of Forest Insects in cooperation with the Appalachian Forest Experiment Station, now with the Soil Conservation Service, Greensboro, N. C.

samples from various parts of the oven until the variation after 8 hours of successive drying was one-tenth of a gram or less. The moisture percentages were computed on the oven-dry weight basis to facilitate presentation and serve as a measure on which to base this discussion.

For each tree, curves of the phloem, outer 2 rings, next 3 rings, center and cross section, respectively, were plotted with the per cent of moisture as the ordinate and the height above ground as the abscissa.

Average figures were obtained for each portion at each interval by classifying the actual weights of the samples. The average percentages were then plotted ove height above ground. (See Fig. 1.)

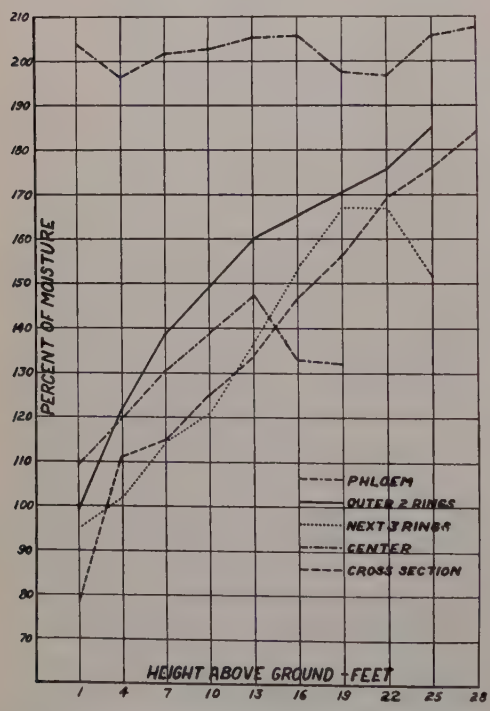

Fig. 1.—Amount and distribution of moisture pine.

Discussion

Although it is known that the moistur content of trees varies with the season time of day, growth, etc., no extende discussion of these factors is included i this paper, since they were not directl investigated. Some of the variations i the individual trees are undoubtedly du to such factors, though an attempt wa made to keep them constant.

In comparing the accompanying result with those of other workers, it should b remembered that these trees are so smal that they consisted entirely of sapwoo and also that the outer two rings includ the immature zylem cells in the cambiun region, which may tend to increase th moisture in the outer 2 rings.

Craib[2] investigated the regional sprea of moisture in a tree for each season His results for June to September compar closely with those presented in this pape Both agree that the maximum amount c moisture is found in the outer rings.

In working on redwood, Luxford found that the amount of moisture in creases from the pith to the outside an from the base of the tree upward. Th accompanying curve of the average cros section follows his curve of the sapwoo with a greater increase in moisture up ward from the base.

Summary and Conclusions

The moisture content of the entire cros section increases regularly up the tre until at the top it is twice as great as a the base.

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[2]Craib, W. G. Regional spread of moisture in trees. Notes from the Royal Botanical Ga den, Edinburgh, Vol. 11; No. 51, 1918; Vol. 12; No. 59, 1920; and Vol. 14; No. 64, 192 illus.

[3]Luxford, R F. Distribution and amounts of moisture in virgin redwood trees. Jour. Fo 28: 770-773, 1930, illus.

It should be particularly noted that the phloem is remarkably uniform in moisture content. No great variation is found between the base and the top. From the limited number of observations it appears that if enough trees were sampled the curve showing the moisture content of the phloem would very nearly approach a straight line.

The curve of the outer 2 rings shows a very regular uniform rise in moisture with a corresponding increase in height above ground. These 2 rings have a higher moisture percentage than any other rings except at the base, 1 foot above ground, where the center is slightly higher.

The next 3 rings also increase in moisture upward until near the top, where it becomes constant, and later falls below its peak. At 4, 7, and 10 feet above ground the next 3 rings are lowest in moisture content; from 13 feet upward, however, they are higher than the center, but still lower than the outer 2 rings. The abrupt drop near the top may be the result of one of two factors, or a combination of both—only 2 observations were made at 25 and 28 feet; if more observations were made, the curve would probably level off and remain so. The other factor is probably more reasonable. Near the top of the tree the rings become so reduced in number that the next 3 rings include the center ring and pith, which is very dry, thereby lowering the moisture content of the whole.

The center appears to be the most variable. At the base it is higher than the outer 2 rings; and increases steadily upward to the midstem, where it suddenly drops below the other layers. At the base there is a larger proportion of the more moist outer xylem, while past the middle of the tree the pith and drier center rings comprise the greater proportion of the sample.

These inter-relations can be more easily visualized by an examination of the curves, which show the trends as well as the actual moisture percentages, which have not been discussed.

More recent investigations on trees from the same tract tend to strengthen these results, but have not been incorporated in this paper.

Survey of Forest Research Projects

THE Committee on Forestry of the National Research Council has undertaken a survey of forest research projects being conducted within the United States, for the purpose of determining neglected fields, indicating projects worthy of additional support, and acquainting the profession generally with the scope of work now under way.

Through regional secretaries, the committee has endeavored to reach all institutions and individuals having research work under way which has a bearing on forest practice. It is requested that any individuals or agencies which have projects that should be included but which have not been contacted by regional secretaries get in touch with the Secretary of the Committee.—Hardy L. Shirley, *University Farm, St. Paul, Minn., Secretary, Committee on Forestry.*

THE NEED FOR INCREASED PUBLIC FOREST OWNERSHIP

By HUBERT L. PERSON

California Forest and Range Experiment Station

RECENT articles by Cary[1,2] and Wackerman[3] include statements concerning public forestry and public employment which should not go unchallenged. Both writers insist that there is no cause for worry as to future timber supplies, and that therefore private industry should be given a free hand to try to work out its salvation through "spontaneous productive forces" without government interference—except for purposes of extending cheap credit, tax relief, and increased fire protection. Subsidies in various forms would probably not be deemed unacceptable.

In these discussions it was assumed that the proposed program of federal acquisition would result in a public monopoly of forestry and that this would be a very bad thing for the entire country and particularly unfortunate for professional foresters.

Much is made of the inaccuracy of past estimates and the fact that we apparently still have adequate timber supplies, on a national basis. It cannot be denied, however, that freight charges constitute a large part of the cost of lumber in regions which at one time led the country in lumber production. Local and regional timber scarcity is a fact today, not a prediction, and a part of the success of lumber substitutes can be attributed to this scarcity.

If we grant, however, that private operation will satisfy the decreasing demand for lumber—at a price—that is not all we have a right to expect from our forest lands. Timber sufficiency is no the only consideration in the manageme of forest land as long as unsound fore practices result in irreparable loss in soc fertility and recreational and wildlif values, in instability of tax income an employment, and in the other evils tha go with transient, exploiting industries.

We are told that the South in partic ular needs no government interference and yet Craig[4] estimates some 20,000,00 acres of tax-delinquent forest lands in th Gulf states, and detailed studies sho that mismanagement was a much mor important cause of tax delinquency tha excessive taxation, except in a few isolate instances. Tax delinquency on such large scale constitutes a breakdown i private ownership with consequent bank ruptcy of communities and general in stability that requires governmental hel —interference, if you will.

Forest land comprises more than one third of our total land area, and ou prosperity depends to a large degree o the wisdom of our management of thi resource. Unless forest lands are manage so that not only timber values but wate shed, forage, wildlife, and recreation a well are protected and developed, w have not fulfilled our duty as foreste and conservationists. It should be em phasized that devastated forest land is no only a loss from the standpoint of pro duction of national wealth but in man instances is a serious menace. For thos who will think of forests simply as s

[1]Cary, Austin, 1935. Austin Cary speaks out. Jour. For. 33:11, pp. 916-922.
[2]Cary, Austin, 1935. A defense of private forest ownership. Jour. For. 33:12, pp. 964-967
[3]Wackerman, A. E., 1935. Some aspects of the proposed public monopoly of forestry. Jou For. 33:12, pp. 968-970.
[4]Craig, Ronald, 1935. The South's no-man's-land. American For. 41:12, pp. 684, 685, 712.

much lumber or wood pulp, Illick's[5] list of fourteen values and influences of forests will be illuminating.

The attempt to place surplus forest productive capacity in the same category with the overproduction of perishable annual crops is based on very poor reasoning. In one case you have a perishable product the production of which entails a drain on soil fertility, and in the other you have a crop which becomes more valuable with age (within reasonable limits) and which protects the soil and adds to its fertility. It is difficult to understand how a forester could condemn the reforestation of denuded lands on the ground that there is danger of making them too productive. One cannot predict our wood requirements for very far into the future, but it is certain that timber scarcity, even locally, will result in increased substitution of steel, cement, and other products where wood should or could be used; and regardless of the need for lumber, forested areas are an important national asset if only as a protection against site deterioration.

That increased federal and state acquisition of forest lands is not proposed simply to enlarge the sphere of public forestry is evident from the fact that many leading lumbermen are supporting this program. The Article X Joint Conservation Program includes the following in support of public acquisition: "To assure permanency of forest industries, communities, and employment and to promote cooperative sustained yield units, public forest acquisition, involving 224,000,000 acres, should be consummated, including not less than 150 billion feet of standing timber. . . ." Many practical lumbermen believe that it would be better from all viewpoints, public and private, for the government to relieve the industry of the costs and risks of excessive timber reserves so that they could concentrate on logging, milling, and selling. There are innumerable operations where companies are cutting on government land exclusively or on intermingled private and federal lands, and to my knowledge such operations are as successful as or more successful than where the operating companies own all of their operating stumpage.

The assumption by Wackerman that this program of federal acquisition would necessarily mean a public monopoly of forestry is hardly justified. In the South, the region discussed in particular by Cary and Wackerman, even if the entire proposed acquisition was completed, which is highly improbable at least for many years, the government would own 40 per cent of the forest acreage and a much smaller percentage of the stumpage. This would leave private owners plenty of land on which to practice forestry—in fact a much larger area than past and present practices indicate would be used for that purpose, regardless of federal acquisition.

A point that is often overlooked is the uncertainty of private management. In order to perpetuate forests, sustained plans are necessary as well as sustained yield. Past abuses should not be held against the lumbermen of the present, but on the other hand, with all forest lands in private control what assurance do we have that present good intentions will continue into the future? We have observed instances where reduction of profits reacted immediately in a reduction in forestry efforts. Is it suggested that we tie all hopes of maintaining well forested lands to the ability of lumber companies to operate profitably, regardless of overcapitalization or poor management? On the other hand, exceptionally favorable markets often result in the abandonment of selective logging for clear cutting, or at least a serious reduction in the diameter limit, as a result of increased prices for poorer grades of lumber. At the

[5]Illick, J. S., 1935. An outline of general forestry. Barnes and Noble.

present time many operators in the South are cutting far below the economic diameter limit and seriously depleting their growing stock.

The foregoing is an attempt to disprove the contention that further federal acquisition is neither necessary nor desirable. Charges by Cary that government acquisition in practice is a form of piracy probably depends again on the point of view. The money used belongs to the people of the Nation as a whole, and the Forest Service has the responsibility of making the most favorable purchases possible. One of the purposes of the acquisition is to insure sustained yield operations. To do this effectively it must buy good timber in strategic locations. It is also evident that the Forest Service buys only with the free consent of the seller, and what may seem like a mess of pottage to Mr. Cary may be very desirable cash to the owner of the property. And in New England the representatives of the people may be right in believing that government acquisition and administration is necessary to restore some of the timber heritage that has been destroyed by private exploitation.

Statements in all three of the articles mentioned depreciate public agencies both as regards efficiency and desirability as fields of employment for professional foresters. Little can be added to all that has been written on the comparative efficiency of public agencies and private industry. It is generally recognized, however, that the better governmental bureaus and services where employment and salary are based on merit compare favorably with private companies and corporations. It is true that it is not difficult to find fault with an organization as large as the Forest Service, but it is equally true that there are glaring examples of inefficiency and mismanagement in the lumber industry, and the average of honesty and efficiency is at least as high in the Forest Service as in the lumber industry or private business as a whole.

As to the effect of increased federal ownership on the forestry profession, it is difficult to see Mr. Wackerman's point. By and large, men are attracted to the forestry profession by a desire for permanency of employment and an opportunity to contribute to the advancement of forestry in the public interest. The Forest Service has been conspicuously free from political domination, and most foresters would undoubtedly find less conflict with their professional ideals in carrying out Forest Service policies than in following the dictates of a private lumberman, who is usually more interested in profits than in public welfare.

And when we consider the number of professional foresters who are employed by private industry in comparison with the number employed by public agencies, it is difficult to become seriously worried about the future of the profession if the federal government increases the area under its control. It would be highly interesting to determine the proportion of forestry school graduates within recent years who have obtained employment, *as foresters*, by private industry. It seems evident that such an analysis would show that the real danger to the profession of forestry would lie in an extension of private ownership at the expense of public ownership.

Graves and Guise have stated: "It is the purpose of forestry to obtain from forest lands and their products the greatest economic, industrial, and human service. The success of forestry is measured in benefits to mankind and its aid to the progress of civilization." In judging the adequacy of present private ownership and the need for further federal acquisition, this broad view of forestry must be used as the basis, not simply present lumber sufficiency.

WHY THE PRAIRIES ARE TREELESS

By G. A. PEARSON

Southwestern Forest and Range Experiment Station

DR. Heinrich Walter,[1] noted German authority on water relations and osmotics, presents his views on the much debated question of why trees have not taken possession of the prairies and other nonforested lands in this country. Because of the definite bearing which his findings in the prairie region of the Middle West have upon silvicultural problems in the Southwest, a rather detailed review and interpretation of his conclusions is here presented. His observations were mainly in the region extending from the Missouri river westward through Nebraska and Kansas to the Rocky Mountains. He spent several months in Arizona about 1929.

Among the many reasons that have been advanced in explanation of the absence of trees on the prairies are: the presence of salts inimical to tree growth; a lack of typical forest soil organisms; dry summer winds; cold winters; deficient precipitation; and, finally, that forests once occupied the prairies but were destroyed by fire and have been unable to return. Dr. Walter dismisses all but the last two. He concludes that the Great Plains and the "short grass" prairies are too dry to support forests; but he believes that the "tall grass" prairies farther east would be forested had not the grasses successfully resisted invasion by trees.

The region to the east of the Rocky Mountains is characterized by a preponderance of summer precipitation, which makes for high run-off and shallow penetration. Going from east to west, along the fortieth parallel, the annual precipitation is 800 mm. in the transition between forest and prairie, about 700 mm. in the tall-grass or "true prairie," about 470 mm. in the short-grass prairie, and 420 mm. in the Great Plains. Similar relations are found in Russia on going from forest to steppe.

The requirements of various types of forest and grasses are thus summarized:

"As a rule, tree growth is possible only where the soil is constantly moist to considerable depths. Summer-green deciduous trees succeed where a good water supply is available during a relatively long warm period. Where abundant winter precipitation is counter-balanced by a shortage of soil moisture in summer, evergreen broad-leaved trees predominate if the winters are mild; but if the winters are severe, needle-leaved trees take possession because they are able to perform the necessary functions in a short growing season.

"The grasses are different; they have a finely and evenly divided root system which occupies the upper layers of the soil, and it is sufficient for their needs if only these layers are moist during a limited period of favorable temperature. During the remainder of the year, be it dry, hot or cold, the roots remain in a dormant state while the aerial parts die. Non-grasslike herbs can function in the same manner; but they do not form the dense turf or thicket type of growth, and therefore never become absolutely dominant as do the grasses. The battle is generally between tree- and grass-vegetation."

In regions of low precipitation, the

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[1]Walter, Heinrich. Ist die Prairie von Natur aus baumlos? (Is the Prairie Naturally Treeless?) Geographischen Zeitschrift, 41 Jahrg, Heft 1, pp. 16-26, illus. 1935.

depth of penetration is marked by a more or less distinct calcium carbonate horizon. A cross-section of the soil profile of the prairie region reveals no calcium carbonate horizon at the eastern extremity, but farther west it appears at a depth of 1 to 1.5 meters and gradually rises nearer the soil surface until in the short-grass prairie it lies at a depth of only 25 cm. The grass roots practically stop at this horizon, and the dry, grey soil underneath is characterized as "dead." The stature of the plants above ground decreases in corresponding proportion.

Several lines of evidence are advanced in support of the conclusion that the true prairies are potential forest land. Artificial plantations on tall-grass land have developed into typical forests, including the characteristic forest soil horizone. The present forest boundary is advancing, where man does not interfere, though necessarily at a slow rate because of the difficulty of overcoming grass competition. Walter cites records by Clements and Weaver along the border line between forest and prairie as indicating how this invasion proceeds. Two common shrubs, *Rhus glabra* and *Symphoricarpos vulgaris*, push out into the grass turf by means of root suckers, establishing new plants which eventually shade out the grass. Tree seedlings then gain a foothold beneath the shrubs and in the course of years grow up and dominate them. By this process the forest pushes back the prairie at the rate of 1 meter in 3 to 5 years. Further advance is seen along drainage courses where erosion has removed the grass.

The capacity of the prairie to repel invasion is forcibly demonstrated by another experiment by Clements, Weaver, and Hanson. The present reviewer has read the original account of this experiment (Plant Competition, Carnegie Inst., pp. 154-197) and has supplied some details omitted by Walter. Four rows of deciduous tree seeds or seedlings of five species were planted in shallow trenches, 4 inches wide, from which the prairie sod was removed. A record was kept during three years. The first trench was supplemented by turning the sod for a distance of 6 inches on each side, thus forming a denuded strip 16 inches in width. The sod was thoroughly broken up by hoeing, which was repeated several times each year to keep out all vegetation other than the trees. This strip is referred to as "mulched," although the obvious purpose was to eliminate plant competition, rather than cultivate the soil. In row number 2 the grass was clipped on a strip 6 inches wide on each side, but the roots were undisturbed. Clipping was repeated throughout the 3-year period. The third and fourth rows were given no further treatment, except that number 3 was watered frequently through the first summer only.

From the first, the seedlings in the denuded strip showed a great superiority in rate of growth, followed by those in the clipped strip. Most of the seedlings in rows 3 and 4 died, and the survivors were very small. In some instances the watered seedlings were smaller than the unwatered ones, indicating that the water benefited the grasses at the expense of the seedlings. Soil moisture samples showed distinctly more moisture in the denuded strip than in the others except, presumably, the watered strip during the first season, for which no values are given. At the end of the second year, the respective heights of *Gledetsia triacanthos* seedlings under the four treatments were: grass removed, 18.0 inches; clipped, 9.0; watered, 4.8; unaided, 9.8. Corresponding figures for *Acer negundo* were: 33.0, 14.8, 9.8, and 5.5; for *Acer saccharinum*, 24.6, 15.0, others all dead; for *Fraxinus lanceolata*, 12.6, others all dead; for *Ulmus americana*, 19.4, 6.4, 3.6, 3.5. In the last two classes the trees were not only

small but also extremely slender and poor of foliage, due to shading.

Examination of the root systems revealed relations corresponding to the top growth. In August of the third year, Gledetsia in the denuded strip had tap roots penetrating to a depth of 6 feet and a strong system of well-branched laterals. In the clipped strip the tap roots penetrated only 5 feet, and the lateral development was weaker than in the denuded strip. In the watered row in the tall grass the tap roots reached depths of but 18 to 20 inches; the most striking feature was the almost complete absence of strong laterals. No data are given for the unaided strip, since the roots were considered similar to those in the watered strip. The retarding effect of the grass is attributed to root competition in the clipped strip, and to both root competition and shade in the undisturbed strips. It is not known whether any of the trees ultimately survived in strips 2, 3, and 4, or even in strip 1; but there is no question as to the handicap imposed by competing vegetation.

It is of interest to recall that the Southwestern Forest and Range Experiment Station has conducted a similar experiment in a nearly pure ungrazed stand of Arizona fescue, *Festuca arizonica*, (JOURNAL OF FORESTRY, May, 1934). The results were almost identical with those obtained by Clements, Weaver, and Hanson. Plots of 1 by 3 meters were denuded, clipped to 2, 6, and 10 inches, burned, or untreated. In 1929, ponderosa pine seed was sown in equal quantities on all plots and raked into the soil. Except for light raking to cover the seed, there was no disturbance of the soil except that on the denuded plot it was loosened slightly in removing vegetation, which was cut about ½ inch below the surface of the ground. Rodents were excluded by fencing the entire series of plots with screen of ¼-inch mesh. Excellent germination was obtained on all plots. The clipping was repeated two or three times each season and the denuded plot was kept free of invaders, but the burned plot was subjected to fire only once. At the end of four years the denuded plot was outstandingly superior to all the others in both survival and height growth. The plots clipped to 2 and 6 inches showed a marked advantage, particularly in height growth, over the plots that were untreated, clipped to 10 inches, or burned.

These relations still maintain after seven years. The denuded plot has been thinned twice to reduce competition between the pines; the plots clipped to 2 and 6 inches each contain 2 seedlings which promise to survive, and several of very subnormal growth; on the plot clipped to 10 inches all died; the burned plot has several, all in the doubtful class; of the two untreated plots one contains a single fairly thrifty seedling in a large opening between grass tufts. Soil moisture samples at depths of 4 to 6 inches and 6 to 9 inches in 1933 showed a distinct advantage for the denuded plot during the June-July dry period, which in this region is always a critical time for small seedlings.

Dr. Walter points out that, once the trees establish a root system below that of the grasses, they maintain themselves, provided that the rainfall is sufficient to support permanent tree growth. This may not prove to be the case, even though plantations make a good early showing. Fields of alfalfa on prairie lands in parts of the Middle West make luxuriant growth the first few years, then decline. This is because alfalfa, by sending its roots to great depths, avails itself of a large stored water supply below the level reached by the grass roots; but when this stored supply is exhausted and is not replenished by rainfall, the alfalfa suffers. Because trees draw moisture from great depths, plantations may encounter the same limitation as alfalfa.

According to the reviewer's observation,

the prairies of the Middle West have their counterparts in the National Forests of the Rocky Mountain region. Corresponding to the short-grass prairies are the short-grass lands below or within the pinon-juniper woodlands. A calcium carbonate horizon is conspicuous in the woodlands of the Southwest, but it disappears in the ponderosa pine type. "Parks," "prairies," and some cut-over lands in the ponderosa pine and Douglas fir types are comparable to the tall-grass prairies of the Middle West. Tall bunch grasses prevail unless prolonged overgrazing has caused them to be replaced by short grasses, weeds, or shrublike plants such as *Hymenoxis floribunda*, *Senecio spartioides*, or *Artemisia*.

Dr. Walter's observation that grasses prohibit or retard reproduction of forest trees is not new to silviculture. In the Southwest, however, not all grasses act in the same way. Arizona fescue, *Festuca arizonica*, offers the most effective resistance because it not only develops an intensive, superficial root system, but also creates too much shade for seedlings of an intolerant species such as ponderosa pine. Another common tall grass, *Muhlenbergia montana*, forms a less dense cover, and its root competition is less severe than that of Arizona fescue because it remains nearly dormant through the dry season of June and early July, which almost coincides with the period in which the pines make their height growth. Blue grama in the pine type likewise makes practically no growth during the dry period of early summer. Periodic overgrazing in all of these grass types distinctly favors pine reproduction, provided that sufficient control is exercised to prevent excessive browsing of the seedlings. Pine seedlings start well among the shrublike weeds that commonly follow overgrazing, because these plants are generally deep- and open-rooted in contrast with the mat-like lateral root system of grasses. Ungrazed Arizona fescue areas in cut-over pine on the Kaibab are on record that have made practically no progress in restocking in 25 years, despite the presence of adequate seed trees. A similar condition has been observed in beetle-killed pine in the Black Hills, on sites that bear a luxuriant growth of tall grass.

Twenty years ago there was much speculation in the Southwest as to the reason for parks and prairies within the pine forest. Records have shown that high wind and low minimum temperatures are adverse factors. In some places a hard pan occurs below the soil surface. But the answer has come in unexpected form in the past decade. Many of the parks are now being invaded by pine creeping out a quarter mile or more from the timber's edge. Government Prairie, several miles wide, on the Kaibab, is dotted with young pines over most of its area. For at least 40 years these grasslands were heavily grazed. About 1926 the numbers of stock were cut approximately in half, and have not increased appreciably since then. Pine seedlings dating back to 1909 and many as recent as 1919, mostly browsed to bushes or mere rosettes, have assumed treelike form in recent years, and are now clearly visible above the grass, which commonly stands over a foot tall. Bunch-grass areas in old cuttings have responded in the same way under a similar history.

Walter concludes that the grasses of the true prairie are able to resist indefinitely the direct encroachment of forest trees. Clements, Weaver, and Hanson found that the chances for success of artificially introduced trees was determined by the degree to which grass competition for soil moisture and light were removed. In the Southwest the grasses seldom become sufficiently dense and tall to exclude tree seedlings completely, but the direction of their influence is the same as in the prairies of the Middle West.

THE PENNSYLVANIA FOREST SERVICE PAST, PRESENT, AND FUTURE

By H. H. CHAPMAN

President, Society of American Foresters

THE Forest Service of Pennsylvania, as an organization of technically trained public employees, was founded by Dr. J. T. Rothrock in 1903. From personal contact with him from 1899 onward I can state that the rock on which he built this Service was that of non-partisan efficiency and merit. While his influence survived, this spirit characterized the organization, and it still persists in those whom he selected and who have given the greater portion of their active professional life to state forestry. This miracle was accomplished in a state in which the traditional attitude towards the public payroll was distinctly that of regarding offices as the perquisites of the party in power. The same beneficial principles were worked out for game protection, with results which placed the state in both of these fields in a position of eminence commanding nationwide recognition and respect.

Before discussing the present and future aspects of this Service, we should state the case for professional rather than political standards of employment in state departments of conservation.

Professional standards are incompatible with political requirements and practices. A profession exists to render expert services to the public, which require a thorough preparation or discipline, educational in character. Such preparation is demanded in order to protect the public from quacks, charlatans, and incompetents posing as experts. The best examples are in medicine and in engineering, and no argument is needed as to the wisdom of entrusting one's health to good physicians, or the designs of modern structures to professionally competent engineers. But the professional standards extend throughout an organization and are built on character, vocational ability, and responsibility of all grades of service including rangers and fire wardens.

Fire protection is the cornerstone in the foundation of forestry practice. The key man is the forest ranger, with his assistants in lookout men, inspection and fire crews. This man must first of all command the respect of his community, or the essential cooperation will fail. He gets this by his character, fidelity to public interests, tact, knowledge and efficiency in methods of fire fighting and prevention, and by his unfailing alertness, a deep-seated sense of responsibility, and fearlessness in enforcing the fire laws. It takes several years to develop a new man into an effective guardian of the people's forests. If such men are replaced for any reason other than inefficiency, the morale of the fire protection system is broken, regardless of who take their place, and future increase in fire losses is inevitable.

The same principles apply in an increasing measure to those who have direct responsibility for the management of public forests. These men must be expertly trained in the scientific or biological aspects of timber growth, the economic field of markets and utilization, and the business principles of administering large areas of public lands. At best, it is difficult to grasp the essential elements of that delicate balance of natural forces which governs plant and animal life, and whose disturbance brings such disastrous consequences in the forest. Without the

basic training of a professional man it is not to be expected, and the mistakes made by those inadequately fitted for such responsibilities are paid for by the public over many years to come. Ineptness in the economic and business fields is equally disastrous, causing waste of public appropriations and loss in the forest itself. The best of judgment and well-considered, long-time policies consistently pursued will alone justify the great programs of public acquisition and management on which the state since Rothrock's time has embarked.

But in striving for these professional objectives, we constantly encounter a theory of public administration which is diametrically opposed to these principles. I need not specify nor describe this idea, except to say that its exponents appear to be genuinely convinced of its necessity in a bipartisan system of government, and even resort to calculations as to the vote-getting power of each political appointment. They do not often attempt to compute the vote-losing or confidence-destroying power of these same appointments, their theory being that the public has no means of expressing disapproval except to replace the ins with the outs, who are tarred with the same brush. In order to stay in, a political organization therefore attempts to mollify or avoid public resentment by "laying off" of certain selected services in which the citizenry are keenly interested, or in making an honest effort to secure continued or equal efficiency when replacing public servants with those of their own political persuasion. Dismissals in such cases are made to rest on reputed inefficiency or political activity of the ousted incumbents, and it is stated that men of equal or superior efficiency can always be found who are also regular in a political sense.

There is but one answer to this. No professional man can efficiently serve two masters. Either he owes his first allegiance to the service of the public in redeeming without fear or favor his full responsibility in the care of the resources entrusted to him, or he gives first place to the party which secured his appointment and to which he contributes, voluntarily or otherwise, a portion of the salary which the taxpayers are called on to produce. To the extent that the first motive rules his conduct, he becomes persona non grata to the local or state party organization. To the extent that he is dominated by the second, his allegiance to public duty and professional standards is undermined, together with his usefulness, and his tenure of office becomes coincident with political changes. Just in proportion as those public servants on whose shoulders rests the future welfare of the state surrender to partisan motives, spend their time and efforts on political organization, and obey the dictates of local or state party bosses in making subordinate appointments and conducting public business, just to that extent is the public interest in conservation betrayed. There is no successful middle ground by which professional efficiency can be retained in the face of the corroding influence of the system of partisan sponsorship for office, and enforced party contributions of time and money out of the public treasury.

What are the conditions in the state of Pennsylvania today as affecting the Department of Forests and Waters? Let me say that these conclusions are well considered and represent a real effort to arrive at the true situation, irrespective of partisanship.

It is claimed that the condition under the present state administration had its roots in practices which antedate this regime by at least 8 years, covering two previous gubernatorial terms, one progressive and one regular; hence that all parties must share in any indictment. It is claimed that the principles of nonpartisan service established by Dr. Rothrock have been gradually undermined

from two sources; that appointments of the forest protective force have during these administrations been increasingly influenced by the sponsorships of political county chairmen, and the appointees have in some instances and to a certain extent responded to this influence by giving political service to the organization sponsoring them. It is impossible to state exactly the extent of this influence, but some evidence seems to exist of a few such cases previous to the present administration. Due to the continuous regime of one political party, there was practically no turnover due to this influence; and the forest protective force, which for the most part was selected on merit and which was held to a high standard of efficiency by the supervisory personnel, did not show any let-down or disintegration because of this condition.

The second fact is that, apparently beginning at the same time, an effort was made to extend the practice of enforced political contributions to the forest organization. This iniquitous method of diverting tax revenues to the support of the party in power destroys at one stroke the professional status of public employees and labels them with the partisan tag to almost the same extent as if the job had been paid for before it was received. It can be justified only on the doctrine that public appointments exist solely for the reward of spoilsmen.

The situation facing the present administration when it came into power was that of a Department in which the office of Commissioner had become a political appointment to be changed with each succeeding governor, regardless of party. Through this fact it ceased to be considered necessary that said Commissioner know anything about forestry, and a definite departure was made from the practice of filling this position with a professional man trained in forestry, and instead, the choice was made on the basis of training in political administration. This course has been followed by the present governor.

With respect to the technical and administrative force, the foresters who have been with the department for decades, the administration was confronted with a dilemna. Should the principles of political spoils and a clean sweep advocated and practiced by certain party leaders representing the state in Congress be ruthlessly applied and the axe used on these trained technicians, or should the wind be tempered to the shorn lamb and reorganization proceed cautiously and with due respect to public opinion and to the need for preserving the efficiency and morale of the Department from too serious a breakdown? On the whole, the latter plan has been followed in part at least, as far as the technical force is concerned. There have been a number of dismissals and replacements among the district foresters, and at Harrisburg. In some instances this was, ostensibly at least, done for the improvement of the service. In other cases it was definitely and purely political, and efficient and loyal state employees were replaced to make room for men of lower calibre and less ability solely because of the demands of local politicians for patronage. To make the picture complete, and to show how impossible this principle is as a working basis for sound public administration, it is definitely known that men dismissed from the Pennsylvania Forest Service were in some instances refused sponsorship or employment by certain federal agencies at the insistence of Pennsylvanians in Congress, or were, in other words, blacklisted. Also, to be fair, it is known that in one instance a man so blacklisted, after securing a nonpolitical position in another state, was discovered to be meddling in the political affairs of the "opposition" party and had to be disciplined.

When it comes to the forest protective organization the replacements run close

to half of the entire force. In each instance the new appointee is placed because of the political sponsorship of local politicians or county chairmen. In a very large percentage of the cases, men of high efficiency have been replaced not only by green or inexperienced men but by persons distinctly inferior in ability, or outspokenly political in character. When this situation was called to the attention of the governor, his reply was that fire losses for 1935 had been less than in previous years. Does this signify that fires can take care of themselves, that green and indifferent wardens are as dependable as a trained force, or that morale and fidelity to public interests are not determinative? One thing is certain, that this "record" is *not* due to increased efficiency brought on by the kind of reorganization which the protection service has undergone.

Not only has the system of political sponsorships thus been continued and strengthened, but the "voluntary" contribution of stipulated percentages of public salaries has been exacted of some men in the employ of the Department of Forests and Waters, largely by word of mouth but none the less mandatory.

In view of this situation, which we believe definitely threatens the future efficiency ofthe Department and jeopardizes the forests of the state, we make the following definite recommendations, the adoption of which seems to us indispensable if the department is to regain its former prestige and redeem its future responsibilities.

1. Removal of the entire organization from political sponsorship or influence. This can best be done by the creation of a Board of Forests and Waters with overlapping 6-year terms, who shall appoint the Commissioner and determine the policies of the Department, absorbing the present Commission, which has never had this control of the appointments and is helpless and moribund.

2. Selection of the Commissioner or State Forester on the basis of exacting legal requirements as to professional competence which would exclude the consideration of men not so qualified.

3. Adherence in all subordinate appointments to the principle of professional responsibility centering at Harrisburg and carried out through district foresters, and the elimination of the form as well as the substance of political sponsorship in recommending or securing appointments.

4. Prohibition by law of the practice of diverting public funds for political purposes by levying assessments or requesting voluntary contributions from office-holders. In breaking up this practice, both the solicitor and the contributor should be penalized.

Is such a program impossible in Pennsylvania? It has been accomplished in other states with far less value at stake. (An abstract of the conservation law passed recently in Iowa is shown below.)

As a matter of fact, the public in this state is as much or even more interested and concerned about their forests, fish, and game, than in other regions. As long as they feel, as on the whole they have been justified in thinking, that the Department is well run and the forests safe, they will let well enough alone. Once their confidence is shaken, as it would be by a bad fire season next year, aggravated by a breakdown in the protective force, they would feel quite differently. We are confident that these changes are demanded as the basis of even a reasonable security for Pennsylvania's forests and wildlife, and urge all interested organizations and citizens to assert themselves in behalf of a future sound and satisfactory management of these resources.

The new conservation law passed by the Iowa legislature provides as follows:

1. A Commission of 7 members, not more than 4 of whom shall belong to the

same political party, and none of whom shall be state office-holders.

2. Overlapping 6-year terms, two or three as called for to be appointed for each biennium after the initial period.

3. No salaries. A per diem allowance and actual expenses.

4. Appointment of a Director of Conservation by the Commission and responsible to it alone.

5. The Director to appoint his own assistants, with approval of commission.

6. All appointees to pass a competitive examination for conservation officer.

7. Power of removal by the Director subject to approval of the Commission.

8. No member, officer, or employee of the Commission shall, directly or indirectly, exert his influence to induce any other officers or employees of the state to adopt his political views, or to favor any particular candidate for office, nor shall such member, officer, or employee contribute in any manner, directly or indirectly, any money or other things of value to any person, organization, or committee for political campaign or election purposes. Any person violating this section shall be removed from his office or position.

9. Divisions created: (a) Fish and Game; (b) Lands and Waters; (c) Administration (accounts, records, enforcement, technical service, and public relations).

THE INDIANA CHARCOAL OVEN

By TORKEL HOLSOE

Ohio State University

LARGE areas of timberland were covered with improvement cutting under the E.C.W. program in Indiana, and it was desirable to find some way to utilize the material that was produced.

Although the forestry camps used wood for heating the barracks, only a small part of the material from the cuttings could be consumed in this manner. Other outlets were therefore desirable, and the production of charcoal for use in nurseries on heavy clay soil was initiated.

At first the old-fashioned dirt kiln method was used; this operation was supervised by Mr. R. F. Boening, who at that time was forester in the E.C.W. camp at Henryville, Ind. Mr. Boening constructed the dirt kilns as follows:

The firewood, in about 3-foot pieces, was stacked up against a center of kindling. When the first layer was about 9 feet across, the next layer was placed on top of it. Slabs were used on the outer side to prevent the dirt which formed the outside cover from falling in among the firewood. The top of the kiln where the kindling came to the surface was left open.

Before the fire was started, some charcoal and kerosene were poured down from the top into the channel formed by the kindling. The fire was started by inserting a torch into a channel close to the base leading into the center of the pile. This channel was formed when the first layer of firewood was stacked, and the hole was closed as soon as the fire was started.

When the fire had a good start, the top was closed with some sod and dirt, and smoke holes were punched in the upper part of the kiln. When blue smoke was coming from the holes, indicating that the wood was charred, the holes were closed and some new ones punched lower down. However, it was necessary to watch the kilns constantly to keep them from caving in. Should this occur, the opening had to be covered immediately to prevent the wood from burning to ashes.

The burning time for a 2-cord earth kiln was about 105 hours, with a return of only about 30 bushels of charcoal. Furthermore, it took considerable time to cool off the kiln, break it down, and separate the charcoal from the dirt covering the kiln. It was desirable, therefore, to improve the method of manufacture.

In the year 1928 the writer had studied different charcoal manufacturing sheet-metal ovens in Europe. It was decided to construct one, to try to improve the efficiency of the work.

The Indiana charcoal oven is of an octagon shape. It is made of 3 parts, the lower and upper sections and the lid. The lower section is made from 8 plates of ten-gauge sheet metal riveted together. On the upper edge a trough is riveted on, into which fits the upper section. This is made from 8 plates of 14-gauge sheet metal. It also has a trough riveted on its upper edge, into which the lid fits. The lid is constructed of 2 half octagons riveted together with 2-inch overlaps. Along the edge angle bars are riveted to fit into the troughs on the upper section. In the middle of the lid there is a hole for a small piece of 8-inch pipe, which serves as a funnel.

Besides these parts, there are 8 8-inch elbows and 16 pieces of 8-inch stove pipe.

In order to get the best result from the

oven, the firewood should be placed in such a way that 8 channels are formed, from the middle of the sides of the oven to the center, where the kindling is stacked. The space between these channels is filled in with wood so that there will be a platform on which to place the firewood. When the kindling is built up in the center, the firewood is stacked in the same way as in the dirt kilns. After the first layer is finished the two sections are placed over the firewood, and the next layer then can be stacked against the kindling in the middle.

When the oven is completely filled up, the lid is placed on and the dirt is placed in the troughs to make the oven airtight. Finally, eight holes are dug under the sides of the oven and the elbows placed in them.

The oven is lighted in the same way as the dirt kiln. A section of pipe is placed on top of the funnel in the lid to establish a good draft. The oven is left in this manner for about half an hour, to insure a good start of the fire. When the crackling of the wood indicates that there is plenty of heat inside, the pipe is taken off and the funnel is closed by placing a bucket-shaped lid over the opening and covering it with a little dirt. Now it is time to place the sections of pipe in connection with the elbows. These are alternated so that every other one acts as an intake, while the others work as funnels.

Fig. 1.—The lower section is being filled with firewood. The upper section and the lid are shown on the right.

The oven now can remain for the next 12 hours without guarding. By that time it will be well to change the draft so that the elbows which acted as intakes will work as funnels. This is done by changing the pipes to the other elbows.

From now on it is well to watch the oven a little, and to close the intake holes whenever glowing charcoal can be seen through them. As the intake holes are closed it will be necessary to shift the pipes, so that the number of intakes and funnels are kept as nearly the same as possible.

After about 24 hours of burning, with a charge of 2 cords of wood, all of the elbows will have shown glowing charcoal and it is time to close the oven.

During the next 12 hours the oven will cool off. If the oven is closed tightly it can be cooled in a shorter time. A good practice is to close the oven in the afternoon; then by the next morning it will be completely dead.

The sections can now be lifted off. The charcoal will be found in a nice pile ready to be taken to the storage place.

The great advantage of the Indiana charcoal oven is shown by the results of an experimental burning with mixed hardwood in the oven compared with a similar burning in a dirt kiln containing the same amount of firewood. These data were obtained in cooperation with Mr. R. F. Boening, who supervised the burning and instructed the C.C.C. helpers. In the calculation it is assumed that the

Fig. 2.—The burning has started and the smoke is coming out of the funnels.

firewood was at the burning place and cut in the right dimensions. Table 1 shows the difference between the two burning methods.

Besides this great saving of labor and time, the oven has one more advantage. The charcoal produced in the oven is of a much better grade than the charcoal from the dirt kiln, where it gets mixed up with dirt.

The highest efficiency from this method of making charcoal will be obtained by having three or four ovens for every crew of four men.

In order to be able to use the charcoal in nurseries it is necessary to grind it rather fine. Up to now the best machine we have found for pulverizing the charcoal is a corn grinder.

Blueprints of the oven, with bill of material, can be obtained from the author by anyone interested.

TABLE 1

COMPARATIVE EFFICIENCY OF DIRT KILN AND INDIANA CHARCOAL OVEN

Labor, man-hours	Dirt kiln	Oven
Stacking wood and building kiln	7.0	....
Stacking wood in oven	....	3.3
Taking out charcoal	8.3	2.8
Night guard[1]	6.4	....
Total	21.7	6.1
Labor expense at 25 cents per hour	$5.43	$1.53
Allowance for amortization of equipment	....	0.50
Total expenses	5.43	2.03
Yield in bushels charcoal	29	65
Expense per 100 bushels	$18.72	$3.12
Time		
Hours required for burning, approximately	105	30
Hours required for cooling off	48	12
Total hours 1 operation	153	42
Total hours 100 bushels, approximately	528	65

[1]Two guards, each working 8 hours per night, in 2 shifts, can take care of 10 kilns. Total man-hours for 4-night run of 1 kiln, $\frac{8 \times 2 \times 4}{10} = 6.4$

Editor's note: The following supplementary notes contributed by R. F. Boening, whose participation in the project described in the preceding article has been mentioned by its author, may appropriately be appended.

With respect to the tabular statement:

"The computation does not claim to be always correct; weather, the species of wood used, and the condition of the wood have a large influence upon the time element. But under no circumstances will the open-air pit excel the steel kiln method. And the grade of the charcoal produced is entirely superior to that produced in the open-air pit."

Regarding the different species of wood used, Mr. Boening stated that "black gum, chestnut, the oaks, tulip poplar, and maple gave the best results. Jersey pine was inferior and we soon discarded it; sycamore too was not satisfactory, and the same for birch. Beech was satisfactory if properly seasoned, that is to say, air-dried for at least half a year. Material grown on high ground was better charred than that from the lowlands."

Mr. Boening said also: "It may be to the point to state why we went into charcoal production. The heavy clay soil in the state nursery at the Clark County State Forest demanded a physical addition to its structure, especially of moisture-retaining qualities. Therefore the charcoal was ground and mixed with the soil. Another intended use from the product is the placing of charcoal near the fireplaces in the shelter houses to be used by the visiting public, and also for general use in camp stoves."

FORESTS AND WATER ASPECTS WHICH HAVE RECEIVED LITTLE ATTENTION

By J. KITTREDGE, JR.

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THE high value of water from the mountain watersheds in southern California is unquestionable. The need for increasing the yield of usable water is equally obvious. My purpose is to suggest possibilities of increasing the water yield by forest management.

Run-off or streamflow is the residual water after the losses by transpiration, interception, evaporation, and deep seepage have been deducted from the precipitation. The rainfall and the deep seepage are little, if at all, influenced by the vegetation. There remain, therefore, the losses by transpiration and interception of the vegetation and evaporation from the soil, which vary with the kind, size, and density of the vegetation and are, therefore, water losses which influence run-off and are subject to modification by forest management. The changes in these three factors with changes in the age, size, and density of forest cover will be followed. No one knows better than I the lack of information by which to do this satisfactorily. The admission of inadequate basis, however, may also serve as a stimulus toward obtaining the needed data. Even now, however, there is some basis for suggesting trends within resonable limits.

Transpiration, interception, and evaporation all three vary with the volume of foliage on an area. Transpiration and interception increase and evaporation decreases as the volume of foliage increases. Inasmuch as the foliage is the machine by which wood is produced, transpiration is likely to follow a trend similar to that of the familiar growth curves for woody species. In Figure 1A the vertical scale represents inches depth of water and the horizontal, the change of age and density from the condition of a clean burn without vegetation at zero years as the forest, either planted or reproduced naturally, increases in age and density. On a clean burn transpiration and interception are obviously nil, and evaporation is a maximum which I have assumed as 12 inches annually. In wood growth we know that the rate is slow during the first few years, then accelerates through the period of rapid growth between 10 and 30 years, and again slows down at the time of the culmination of the current increment, for most tree species about 40 years. If the foliage volume, and consequently the transpiration, follow this same trend, transpiration will start at zero, rising slowly the first 10 years, then rapidly to 30 years, and culminating at 40 years, when the maximum foliage volume is attained and the use of water amounts to 12 inches annually. Thereafter there is a slow decrease with advancing age, becoming more rapid as the stand loses trees in old age.

Interception, which also varies with foliage volume, should have a somewhat similar trend; and it is accordingly shown as reaching a maximum of 6 inches at 40 years, thereafter again slowly decreasing. Evaporation, which starts at a maximum of 12 inches from bare soil, will decrease as the forest grows, slowly at first, then rapidly, becoming a minimum of 2 inches at the time of the culmination of the current annual increment. Thereafter it would increase slowly, and somewhat more rapidly in old age.

On the subject of evaporation, it is generally assumed that there is a loss of

water by evaporation from snow surfaces, as from soil. In March, 1934, measurements designed to determine losses by evaporation from snow at 5,000 feet in Tuolumne County, Calif., showed gains rather than losses. In other words, at certain times of the year at least, with the temperature relations existing in snow and air, the saturation "deficit" of the atmosphere contiguous to the snow becomes an excess, and condensation of moisture on the surfaces of the snow crystals takes place. For that period in March the gain or the excess of condensation over evaporation amounted to about 0.01 inch of water per day, or 0.3 inch per month. Whenever and wherever this situation exists, the evaporation curves and consequently the losses of water would be less, and the yield of run-off correspondingly greater.

The run-off or streamflow varies inversely as the sum of transpiration, interception, and evaporation. The summa-

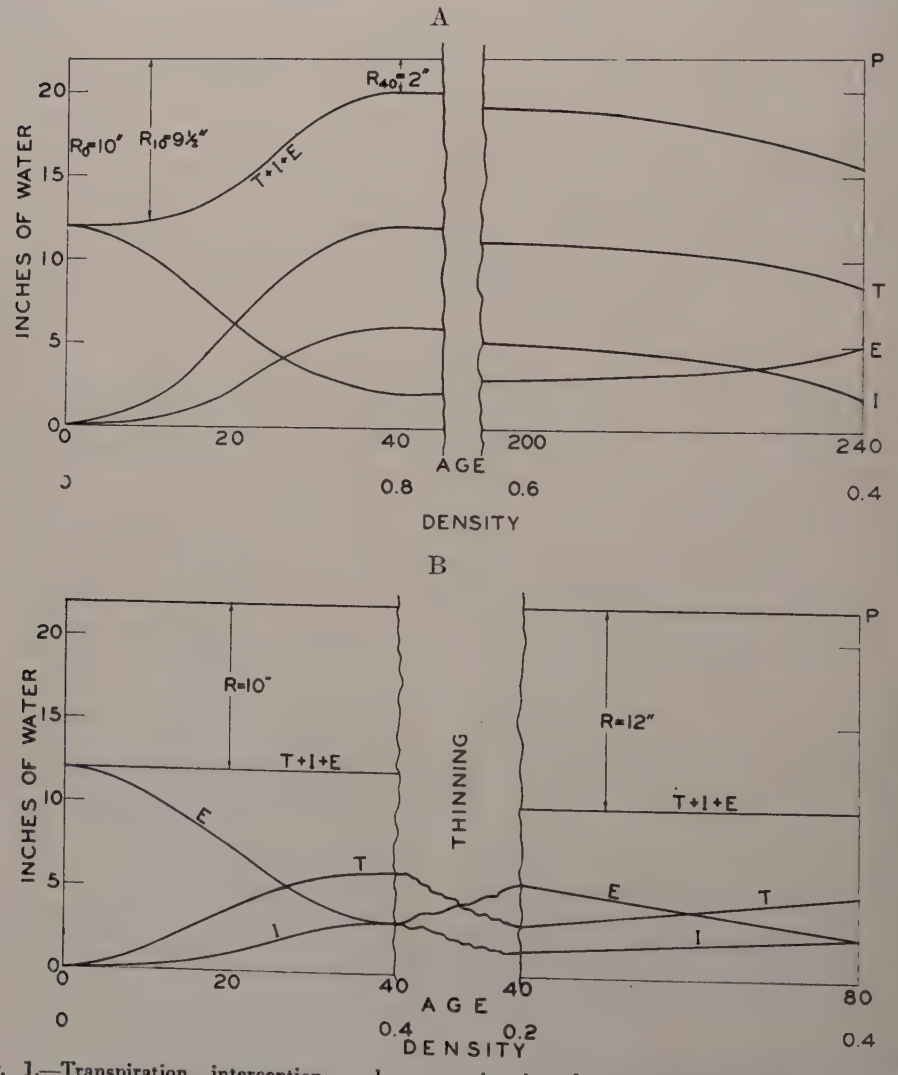

Fig. 1.—Transpiration, interception, and evaporation in relation to precipitation and run-off.
A. Foliage density 0.0 to 0.8. B. Foliage density 0.0 to 0.4.

tion curve is controlled by the transpiration and interception, and rises from 12 inches on bare land to 20 inches at 40 years. The run-off, being the difference between the precipitation and the sum of transpiration, interception, and evaporation, would therefore, be: 22 minus 12, or 10 inches, from the clean burn; 22 minus 12½, or 9½ inches, at 10 years; and 22 minus 20, or 2 inches, at 40 years.

In other words, a dense forest of maximum foliage volume transpires and intercepts more water than it saves by reducing evaporation. This is the reason for the findings of Hoyt and Troxell and others that fire or deforestation increases water yield. It may be the usual case in dense and well-developed forest. The disastrous results, however, of denudation by fire as a means of attaining maximum yields of water have been amply demonstrated recently in southern California. On the other hand, in the interests of water economy, if a ten-year forest stand gave sufficient protection to the soil it would be desirable to maintain that size and density rather than to let the trees grow older. The data to plot such curves are not available, but it is certain that the trends will vary with species and that they can be modified by forest management.

In Figure 1B, a case is assumed where the burn is planted with wider spacing between the trees, so that at 40 years the stand has only .4 instead of .8 crown density. The curves for transpiration and interception will then rise only one-half as high, to 6 and 3 inches respectively, and evaporation will fall only to 3 inches. Under these conditions the sum of transpiration, interception, and evaporation will remain constant at 12 inches, and the run-off will similarly be constant at 10 inches as the stand grows older. If then at 40 years the stand is thinned by removing trees so that the density is reduced from .4 to .2 and the slash and litter from the trees cut is scattered to protect the soil and reduce evaporation, the result might be a reduction of transpiration and interception greater than the increase in evaporation. If that were the case, the sum of transpiration, interception, and evaporation would be reduced to 10 inches, leaving 12 inches of water yield until such time as further treatment might be applied. There is no proof that these figures can be realized, nor can they be disproved at present. I am looking forward to the results of the work of the Forest Experiment Station on the San Dimas area in southern California, to supply much-needed information on some of these points.

The stage in the development of forestry in this region when the case against fire has to be proved must surely be passed for all who have eyes to see. The stage has arrived when refinements in management are in order. The value of water in southern California amply justifies measures which elsewhere for timber production would be unthinkable. The objective is clear; to select species of minimum foliage volume and transpiration, and maintain them by forest management at minimum sizes and densities compatible with protection of the soil.

It may be that some of the native chaparral species, such as scrub oak, may be the best for the purpose. Grass may be a form of watershed cover of low transpiration and interception which would yield correspondingly large proportions of the precipitation in streamflow. Grass will certainly give different results from chaparral or trees. For example, in preliminary results from run-off plots in grassland and in a pine plantation near Berkeley, Calif., the pine yielded surface run-off in all rains over 0.3 inch and the grassland only in those over 0.7 inch. But the grassland yields were greater in the heavier rains; furthermore, undisturbed grassland is a thoroughly effective protection from soil erosion.

FOREST FIRE DAMAGE STUDIES IN THE NORTHEAST

III. Relation Between Fire Injury and Fungal Infection

By PAUL W. STICKEL and HERBERT F. MARCO[1]

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Observations on burned-over areas show that in northeastern forests between 28 and 45 per cent of fire-scarred live trees become infected with fungi, causing decay of the sapwood, within three years after burning. In northeastern hardwood stands, where merchantable values are so largely confined to butt logs, the presence of decay at the base is especially serious. The rapidity with which these sapwood rots infect the damaged live trees after fire indicates the necessity for early salvage cuttings if deterioration of such trees is to be prevented.

IN THE previous articles of this series (8, 9), attention was directed to the mortality and insect depredations which take place on burned-over areas in the Northeast. No discussion of damage to trees by fire can be complete if account is not taken of the inevitable aftermath of fungal infection and subsequent decay. Since very few fungi causing the decay of wood are capable of attacking uninjured bark and sapwood directly, the open basal wound resulting from fire is one of the most prevalent means through which such wood destroyers enter their host. For other regions than the Northeast, the relation between fire scars and decay has been investigated, among others, by Boyce (1), Hedgcock (2), Hepting and Hedgcock (3), Kaufert (4), Lentz (5), Meinecke (6), and Schmitz and Jackson (7).

After fire has swept through a stand, the forester is faced with the perplexing problem of what should be done with the area. As far as the dead trees are concerned, the problem is relatively simple, yet even for this type of injury few data are available as to the maximum length of time the dead trees can be left standing before decay becomes so marked as to make salvage cuttings impractical. As far as the trees which survive are concerned, it has been believed generally that, aside from the fire scar and a possible temporary reduction in the rate of growth, no other serious defects occur. It was assumed, therefore, by many fire wardens that such basal-scorched trees could be counted on to form a part of the ultimate crop, at which time they would be largely merchantable except for the fire-scarred area, which would be culled.

Periodic inspections of burned-over areas prove that this belief is erroneous, and furthermore, that as far as future cull is concerned, the fire scar *per se* is probably of less consequence than the decay which is so intimately connected with this type of fire injury. The data which follow indicate that the infection by fungi causing sapwood rot is so rapid on trees which survive burning in northeastern forests that the removal of all butt-scorched trees as soon as possible after a fire is a sound silvicultural practice, both from an economic and a sanitary point of view. Although the basic

[1]Grateful acknowledgment is made by the authors to Dr. Perley Spaulding, senior forest pathologist, Bureau of Plant Industry, U. S. Department of Agriculture, for identification of the fungi and for review of this manuscript.

[2]Maintained by the U. S. Department of Agriculture at New Haven, Conn., in cooperation with Yale University.

data are not adequate to make distinctions between tree species, there is every indication that the interval between fire-injury and cutting should not exceed two growing seasons at the outside in order to forestall serious saprot.

The following data were obtained from a series of six permanent study areas, three of which are representative of the scarlet oak-black oak (*Quercus coccinea* Muenchhausen—*Q. velutina* La Marck) and chestnut oak (*Q. montana* Willdenow) cover types; and three of which are typical of the red spruce (*Picea rubra* Link) cover type. The oak type study areas have been discussed previously in some detail as to time of burning, area burned, and stand composition (9). The red spruce cover type study areas were established in 1933 in a thousand-acre burn which occurred at Tahawus, Essex County, New York, during July, 1932. The area had been heavily logged for pulpwood during 1931, and the fire burned with unusual intensity because of the large volume of slash present.

TABLE 1

CONDITION OF TREES THREE YEARS AFTER FIRE DAMAGE

	Red spruce cover type		Oak cover type	
Live trees	Number	Per cent	Number	Per cent
Insect infested	9	25	3	2
Insect and fungus attacked	2	6	12	9
Fungus infected	8	22	48	36
Only fire scarred	17	47	70	53
Total	36	100	133	100
Dead trees[1]				
Insect infested	9	43	85	73
Insect and fungus attacked	6	29	17	14
Fungus infected	—	—	5	4
Only fire scarred	6	28	10	9
Total	21	100	117	100

[1]All these trees were alive when the study was initiated.

TABLE 2

RED SPRUCE COVER TYPE

Deciduous hosts	Fungi	Frequency
Sugar and red maples (*Acer saccharum* Marshall and *A. rubrum* Linnaeus), yellow birch (*Betula lenta* Linnaeus), and aspen (*Populus tremuloides* Michaux).	*Polyporus pargamenus* Fr.	4
	Fomes igniarius va. *laevigatus* Fr.	4
	Daldinia concentrica (Bolt.) Ces. & de Not.	1
Coniferous Hosts		
Red spruce (*Picea rubra* Link) and balsam fir (*Abies balsamea* [Linnaeus] Miller).	*Dasyscypha agassizii* (B. & C.) Sacc.	5
	Polyporus abietinies (Dicks) Fr.	2
	Panus sp.	1
OAK COVER TYPE		
Coniferous hosts		
Scarlet, chestnut, red, and white oaks (*Quercus coccinea* Muenchhausen, *Q. montana* Willdenow, *Q. borealis* Michaux f., and *Q. alba* Linnaeus), gray birch (*Betula populifolia* Marsh), and pignut hickory (*Hicoria glabra* [Miller] Sweet).	*Polyporus pargamenus* Fr.	44
	Polyporus gilvus (Schw.) Fr.	8
	Hydnum ochraceum (Pers.) Fr.	2
	Hypoxylon cohaerens (Pers.) Fr.	2
	Schizophyllum communae Fr.	1
	Corticum sp.	1
	Stereum sp.	1
	Hymenochaete sp.	1

Since the date of their establishment (1933), the study areas have been examined annually in order to follow the rate of mortality and subsequent decadence of trees which appeared to survive the fire. It was strongly suspected at the time the 1934 examinations were made that many of the trees were infected with decay-causing fungi. However, with but one exception, which will be mentioned later, no outward visible indications, such as the occurrence of sporophores, were noted on any of the trees. The 1935 inspection revealed almost unbelievable development of fungal population on many of the fire-scarred trees. In the data presented in Table 1, trees reported as fungal-infected represent only those fire-scarred trees on which fungal sporophores were actually found and identified.

Fig. 1.—A butt-scorched scarlet oak infected with *Polyporus pergamenus* Fr., Ramapo, N. Y. Note the almost perfect coincidence of the fire scar and the area of fungal sporophores.

From Table 1 it is evident that within three years after being fire-injured, the percentage of decay-infected live trees in the red spruce and oak types amounted to 28 and 45 per cent respectively. Fungal infection is also relatively high on trees which were not killed outright, but which died within three years after the fire; in the red spruce cover type 29 per cent of the dead trees are also decay-infected, whereas in the oak type fungal sporophores were found on 18 per cent of the dead trees.

The species of fungi and their frequency of occurrence on the butt-scorched live trees are shown in Table 2.

It must not be assumed that these fungi are superficial secondary species of little importance as far as rot is concerned. With the exception of the species of *Daldinia*, *Dasyscypha*, and *Hypoxylon*, the remaining fungi are generally recognized as active wood-decayers. With only one of these species is there any question as to the relation between fungal infection and fire injury; *Fomes igniarius* va. *laevigatus* Fr. is a true heartwood-decaying fungus, hence its presence is indicative of infection which occurred previous to the fire. It will also be noticed that in the red spruce cover type 17 fungal infections were observed, though the number of diseased trees was only ten. This is because more than one species of fungus occurs on many of the trees.

In pointing out the relationship between bark beetles and fire-damaged hardwoods, Stickel (8) mentioned that the ambrosia beetles of this group of insects confine their activities largely to the area of dead wood which generally follows closely the outlines of the discolored bark. Such a confinement of attack is likewise true as far as fungal infection is concerned, and because of the greater visible manifestation of the fungal sporophores in contrast to the boring dust of bark-beetles, the evidence of the relationship between decay and fire is even more apparent and striking.

Figure 1 presents a condition common to many of the diseased live trees. It will be noticed that the area occupied by the sporophores follows closely the pattern of the fire scar.

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DROUTH SUSCEPTIBILITY OF EVERGREEN TREES IN IOWA

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THE history of windbreaks in Iowa begins with the planting of the quicker growing species of trees. Cottonwoods, willows, box-elders, and silver maples were the most favored several decades ago, when the open prairies of Iowa began to be dotted with farmsteads. After a few years these short-lived, brittle trees began to lose their ability to give what little wind protection they had given with leafless branches from the bitter winter winds so common in Iowa. The Iowa farmers then began turning to trees of more lasting qualities and greater effectiveness in reducing the velocities of icy winds.

The earliest records of the Iowa Horticultural Society show that in 1867 a plea was made for the planting of "the more enduring trees" such as oaks, ashes, hickories, and black walnuts. Efforts were made in the late '70s to start in Iowa conifers native to the Rocky Mountain regions from seed collections made by residents of the forts in Montana, Arizona, and the Dakota territories.

The First Annual Report of the Iowa Horticultural Society, 1867, records a discussion in which evergreens were ranked as follows for their desirability as windbreaks: Norway spruce, white pine and Scotch pine, Austrian pine, balsam fir; red and white cedar also were mentioned. In this same report, however, other parties urged the planting of cottonwoods, willows, and soft maples, indicating that the efforts to establish evergreen windbreaks at that time were among the first.

Evergreen windbreaks are desired about farmsteads because of their ability to effectively check winter winds, and because they do not require so large an area as deciduous trees. Evergreens planted for windbreaks should be dedicated exclusively to this purpose with no thought given to utilizing them for fuel, posts, poles, or saw logs, unless large enough blocks are planted to serve these additional purposes without removing the wind protection. Such large blocks have come to be considered as woodlots rather than as windbreaks, because of their ultimate products, even though they are sometimes located to give wind protection to farm buildings and feedlots.

In 1922 forestry officers working through the Iowa Agricultural Experiment Station and the state extension service made a few experimental evergreen windbreak plantings on farms in cooperation with the farmers. The plan of these plantings involved as few rows as possible to give effective protection. These plantings, serving as demonstrations of the best windbreak planning, planting, protection, and care, have increased yearly until 1934 when over 600 were on record.

These demonstrational plantings contained just about every species of evergreen tree that would grow in Iowa, but the majority of the species planted were those which were the earliest to be planted in the state.

Early in the spring of 1934 many observations of winter injury to evergreens were made, and reports came from all parts of the state of the severe losses among both small and large trees. This prompted a survey of demonstrational windbreaks to determine the losses with a view of rebuilding the projects. In the course of this survey it was possible to conclude that certain species of evergreen trees suffered more than others, and that

death and damage among certain others was low. These conclusions are brought out in this paper.

But first a general summary of weather conditions bringing about these losses is in order. It was recognized that there had been rather high losses due to drouth in previous years, but not so heavy as during the winter of 1933-1934. This was due no doubt in part to the cumulative deficiencies in precipitation of previous years, with the most severe drouth conditions occurring in the winter months of 1933-1934.

Five mild winters occurred in succession, starting with the winter of 1929-1930, and all were deficient in precipitation except 1931-1932. The drouth gradually became more intense. There was much sunshine, many clear days, and much high wind which resulted in dust storms. Wells dried up and water was being hauled for livestock. The drouth period was climaxed by the winter of 1933-1934, which was the most severe.

It was recognized that but low survival could be expected among trees planted during the drouth period, but plantings made prior to 1930 should have become well enough established in order that it could be determined what species of evergreens were capable of living through any recurrence of drouth. Therefore, from plantings made in 1929 or prior to that date, computations were made for the data herein given. It was further considered that evergreens are more subject to drouth injury during the winter than at any other season.

In computations only losses and damage suffered during the winter of 1933-34 were recorded. It was impossible in most cases to find trees which had died in previous seasons, but wherever found they could be easily identified as older injury, and consequently were not tabulated.

In Table 1, it will be noted that white pine, red or Norway pine, Scotch pine, and arborvitae are shown as having sustained high losses and damage. White pine, a native of northeastern Iowa, has been extensively planted throughout the state in windbreaks because of its rapid growth and other characteristics suitable for a good windbreak tree. Therefore its failure is a great disappointment. Hundreds of white pine windbreaks in the state were so badly damaged, or lost such a great number of trees by this drouth, that their efficiency has been impaired to a very great extent, and many windbreaks are going to have to be entirely rebuilt, others almost entirely rebuilt, due to the heavy losses among white pines.

The damage to white pine occurred in the crown of the tree. In many trees only the lower whorl or two remained alive. In almost every case the damage was, first, death of the leader, and thence downward. Some of these trees can be restored to windbreak efficiency within a few years of normal conditions if a side branch is brought into an upright position by lashing it to the dead leader and later removing the dead portion when the side branch so erected has started its vertical growth.

This great damage to white pine removes it as a tree suitable to recommend for windbreak planting in certain portions of Iowa, principally the plains areas. In the hilly regions of the state, white pine did well on north slopes. The extensive plantings of white pine windbreaks in these sections in the future would breed the possibility of further heavy loss and impaired efficiency to farmers who use them for that purpose, with any subsequent severe drouth. This possibly does not apply to woodlot plantings of white pine, for those white pine plantations observed were in good condition where the trees were planted in large blocks and closely spaced. In such woodlot plantings forest conditions are more easily maintained, which, no doubt, ac-

counts for the ability of this species to withstand drouth when so planted.

Scotch pine suffered a 20 per cent loss by death and 10 per cent damage to the remaining living trees. Scotch pine, once a favorite, has been losing popularity as an Iowa windbreak tree, so it is not surprising that the tree should make a poor showing in this case. It too should not receive recommendation hereafter as a windbreak tree in Iowa.

The red or Norway pine has not been extensively planted in shelterbelts in Iowa. Due to its heavy toll during this dry winter, 38.9 per cent loss and 6 per cent damage in 16 windbreaks of 7 counties, it should be eliminated as a favored tree for windbreak planting in Iowa. This cannot be said, however, in regard to the tree for plantings as extensive and compact as woodlots, where forest conditions can more perfectly be created. In the one planting of this latter character observed in the state, red pine made a creditable showing. In the same planting, white pine did well but Scotch pine failed to show up well during the severe dry period.

White cedar or arborvitae, a tree which heretofore has been used in windbreak plantings to occupy ground usually more moist than normal, showed a loss of 6 per cent and damage of 28.6 per cent. This damage is not so serious as in the pines mentioned, due to the remarkable ability of the cedar to recover after being defoliated. Winter injury to this tree is common, but when slight, this injury is soon overcome. When repeated over two or more years, however, there could be little chance of the tree remaining effective for windbreak purposes. The tree could, hereafter, be used sparingly in windbreaks of the state where ordinarily the soil is too moist to support other evergreens.

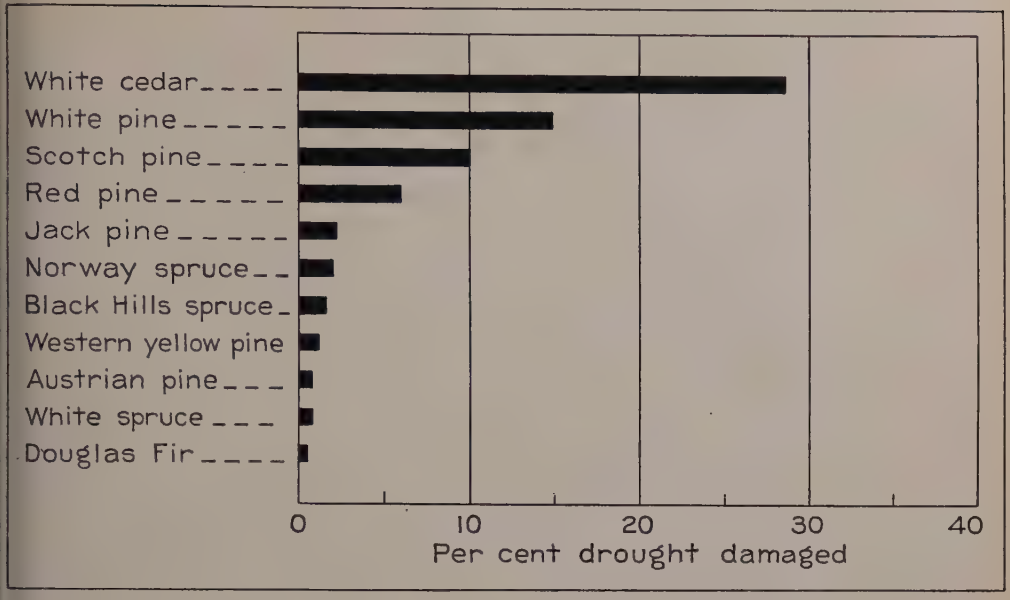
Norway spruce, the tree more commonly used in recent years, and second in number in the state to white pine in windbreaks, does not show well in this study.

TABLE 1

CONDITION OF EVERGREEN TREES OF VARIOUS SPECIES PLANTED FROM 1922 TO 1929, AFTER THE 1933-34 WINTER DROUGHT

Species	Number of living trees	Trees drouth damaged		Trees died in 1934		Number of windbreaks	Number of counties
		No.	per cent	No.	per cent		
Douglas fir[1]	1602	8	.5	55	3.3	48	13
Norway spruce[2]	5328	107	2.0	515	8.8	152	27
Black Hills spruce[3]	1068	17	1.6	14	1.3	26	9
White spruce[4]	246	2	.8	4	1.6	19	12
White pine[5]	4304	642	14.9	501	10.4	103	25
Red pine[6]	199	12	6.0	126	38.9	16	7
Western yellow pine[7]	1109	13	1.2	66	5.6	47	20
Austrian pine[8]	123	1	.8			11	5
Scotch pine[9]	642	64	10.0	160	20.0	24	20
Jack pine[10]	184	4	2.2	3	1.6	10	7
White cedar[11]	1169	334	28.6	73	6.0	42	18

[1] *Pseudotsuga taxifolia.*
[2] *Picea excelsa.*
[3] *Picea canadensis, Var. albertiana.*
[4] *Picea canadensis.*
[5] *Pinus resinosa.*
[6] *Pinus ponderosa.*
[7] *Pinus austriaca.*
[8] *Pinus silvestris.*
[9] *Pinus banksiana.*
[10] *Thuja occidentalis.*



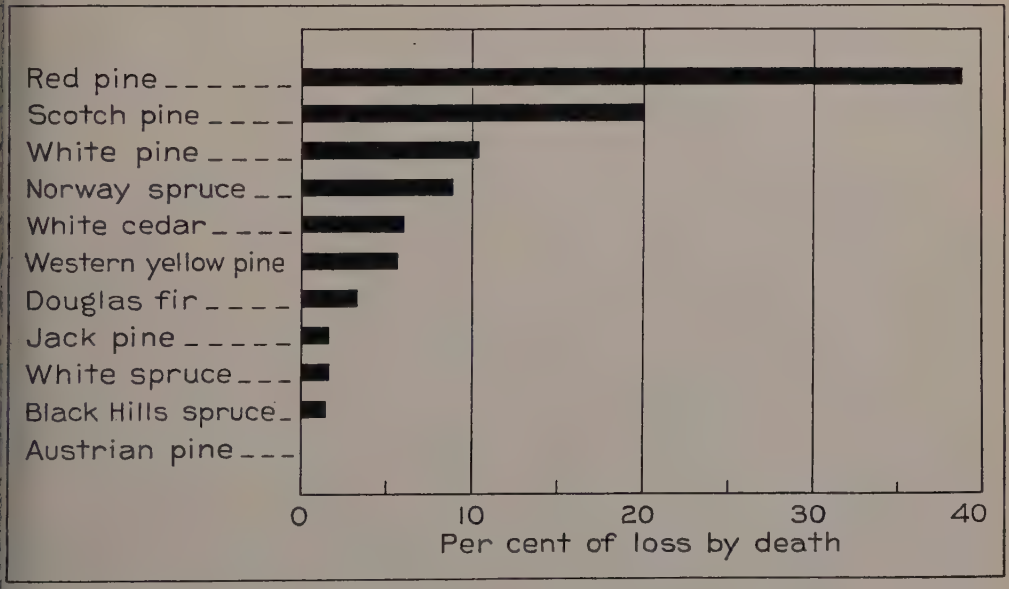


Fig. 1.—Percentage of loss by death, and of drouth damage.

but the damage it sustained does not prevent its use where good soil conditions can be maintained by cultivation and mulching during early life and complete protection throughout its life from intrusion of livestock and chickens. The losses this tree suffered in the older groves of the state were due mostly to overcrowding in the plantation, and lack of protection of the soil beneath them from trampling by animals and chickens. Drouth was the secondary cause of death or decline. The loss by death of 8.8 per cent and the damage of 2 per cent is imposing enough to put the Norway spruce farther down on the list of trees recommended for windbreak planting.

Jack pine has been planted too sparingly in the demonstration windbreaks to make the computations derived in this study appear significant. However, this species has little to recommend it as a windbreak tree because of its sparse foliage and narrow crown. Its use in the past has been confined to soils too sandy to support successfully any other evergreen.

In this study Douglas fir showed a loss of only 3.3 per cent and but .5 per cent drouth damage. In most windbreaks this tree maintained a good appearance, and the losses it sustained can be considered but slightly above what could be expected during normal weather. In addition, the losses shown represent almost wholly the losses of this species throughout the dry period from 1930 to 1934. This cannot be said in regard to species heretofore mentioned.

Considering the average Iowa windbreak to contain 100 trees, this low loss (3 or 4 trees over a 5-year drouth period) is indicative of the value of Douglas fir as a windbreak tree. The tree grows more rapidly than any other evergreen used in Iowa except the white pine, attaining heights of 15 to 18 feet in 10 years. In developing Douglas fir for windbreak planting in this region, however, care should be taken to secure seed from east of the Cascade Range.

Austrian pine has been used almost as long as any other evergreen tree in Iowa windbreaks, but not in great numbers. The losses sustained, only .8 per cent in 11 windbreaks in 5 counties, indicate a figure even below what the loss could be under normal rainfall. The tree has many characteristics making it a suitable windbreak tree, and should receive great consideration in future plantings.

The western yellow pine, or ponderosa pine, in 47 windbreaks in 20 counties showed a loss slightly above what could be expected in normal years. The rapid rate of growth attained by the tree marks it as a rival for Douglas fir to top the list of recommended windbreak trees for Iowa. It should be planted more extensively than during the past.

Black Hills spruce and white spruce will be considered together, since the former is but a white spruce which has acclimated itself to conditions found in the Dakota Black Hills. This enables the Black Hills strain to be quite drouth resistant. The white spruce is more rapid growing than the Black Hills variety; in fact, many farmers prefer other varieties to Black Hills spruce on account of its slow growth. Under ideal care, this writer believes that the Black Hills spruce can be made to attain effective windbreak heights in a shorter time.

Factors which add to the damage to evergreens during drouth periods are crowding, lack of protection from livestock and poultry, and lack of proper drainage of wash from barnyards.

Where the rows of trees are spaced too close together or where the trees are too closely spaced in the rows, there is retardation of growth. In years of moisture deficiency the crowded condition makes the competition for moisture more keenly felt. Trees are bound to falter and many to die if the dry period is protracted. Evergreens should not be

spaced less than 16 by 16 feet, and a spacing of 30 feet may be considered good for such trees as Austrian and western yellow pine.

Oftentimes plantings have been closely spaced with the intention of taking out alternate trees later. This plan is good if followed, but so often the thinning operation is overlooked or neglected until too late. Farmers usually have their attention exclusively taken by agricultural pursuits and without the advice of a forester excusably overlook the need of thinning when it can be effectively done. In addition, the farmer "just can't" cut a tree when it is in good health. This can be more readily understood when one considers that there are too few trees anyway about the farm houses of the plains counties. Considering this, it is thought best to space the trees far enough apart in planting so that they will not need thinning. The intervening space can be used to advantage for garden or field crops for several years. Once the trees prevent this use, the windbreak will be so valuable for its efficiency in blocking winter winds that the space it occupies can well be devoted permanently to the trees exclusively. Deciduous trees crowding in from adjoining woodlots or from sprouts among the evergreens make dry times more difficult.

Lack of protection from livestock is a very important primary cause of high mortality in evergreen windbreaks. The windbreak should be permanently fenced. In early life a garden maintained between the rows will need protection anyway, and will serve to utilize the between-row land to better advantage than for grazing. The use of crops will aid in keeping the soil about the trees in good condition and prevent choking out by weeds. Stock not only browse upon the trees but pack down the soil or encourage the growth of heavy sod.

It is common to minimize the damage done by chickens to evergreens. Without doubt the presence of chickens in windbreaks accounts for much of the loss during drouth. Even in years of normal rainfall young evergreens are killed by chickens scratching about them, exposing their roots and packing the soil. Chickens should be kept out at all times.

The drainage from manure yards will kill evergreens if allowed to drain over the planting site. A method of concentrating this wash and diverting it around or through the evergreen planting will prevent the loss of many windbreak trees.

Summary

Evergreen windbreaks planted about farmsteads in Iowa are more effective, longer lived, and require less area than plantings of deciduous trees. Such evergreen plantings are best dedicated exclusively to the purpose of wind protection, with no thought of utilizing the trees for fuel, posts, poles, or saw logs.

The drouth of 1930-1934 proved damaging to some species of evergreens planted in Iowa windbreaks. Tabulations of losses by death and damage to remaining trees due to the drouth in the one year 1933-1934, when a very dry winter occurred, were made. From this study it was concluded that Scotch pine and red or Norway pine could no longer be safely recommended for windbreak planting in Iowa. Furthermore, the use of white pine upon the plains areas of Iowa cannot be recommended. Species which could, by virtue of their good record of survival during the dry winter of 1933-1934, be recommended for Iowa windbreaks are, Douglas fir, western yellow pine, Austrian pine, Black Hills spruce, and white spruce. Norway spruce, white cedar, white pine, and jack pine may be recommended with reservations.

Practices of wider spacing, cultivation, protection from livestock and poultry, and diversion of drainage from manure yards will keep evergreen windbreaks in better condition and thus prevent drouth injury as a secondary damage.

BRIEFER ARTICLES AND NOTES

Wildlife Conference

The Wildlife Conference called by the President in Washington February 3-8 developed a number of new trends which are of direct interest to foresters.

Probably of first importance is the change in make-up and sponsorship of the Conference itself. In past years wildlife groups other than the game group participated only "by invitation." This year all groups participated on an even footing. The former sponsor, the American Game Association, was directly supported in part by industrial funds. This year a new and separate repository for industrial funds has been set up—the Wildlife Institute. New kinds and larger amounts of industrial support have been signed up, but the Institute has no vote in the affairs of either the general Wildlife Federation, which supplants the former American Game Association, or in the Wildlife Conference, which supplants the former Game Conference. That is to say, there is now a complete divorcement as between the public forum on wildlife (the Conference), and industrial support for wildlife work (the Institute). Obviously these changes are aimed to bring about a set-up which is at once more powerful and more sound than the pre-existing set-up.

It is common knowledge that the groups now federated for expression of their views through the new Conference are widely divergent in both objective and method. They include all the contending factions which have heretofore constituted a sort of "balance of power" in the wildlife field. Under the new set-up they have virtually agreed to do their contendi face to face across the conference tabl rather than at long distance by the w of the inkpots. Whether the mutual toler tion and sympathy requisite to the dur tion of such a truce will be forthcomin may remain an open question. It ma nevertheless be set down as progress th the contending groups are willing to tr

The papers presented at the Conferen were so numerous and various that on a few trends impinging directly on fo estry can be mentioned. The public d main question, for example, was muc to the forefront; likewise the related que tion of federal jurisdiction over Nation Forest game. No basically new argumen were presented.

The C.C.C. was repeatedly discusse both as an agency beneficial to wildli management and as a danger to wildli by reason of its road-building and timbe stand improvement activities. The publ is clearly becoming aware of the fact th the sudden availability of an infinite labo supply has caught many foresters unpr pared to execute a multiple land-use pr gram. It is only fair to say also th this critical public has little realizatio of the complexity of the problems i volved, but no papers were presented t elucidate this side of the story.

One interesting offshoot of the allege misuse of relief labor was the clear co tention by several speakers that the e panded wildlife program has done litt or nothing for nongame species. It w explicitly charged, for example, that t grizzly, the mountain sheep, the sage he the trumpeter swan, and the caribou wer if anything, in worse rather than bett

atus since the initiation of the combined bor, land purchase, and road building rogram. It was recomended that an in- rbureau committee undertake an inven- ry of rare and threatened species to the d that management and land acquisition rograms might be directly focused upon eir needs. A resolution to this same d was later passed by the Wildlife ommittee of the National Research Coun- l, which added the recommendation that e Natural Resources Board furnish an xecutive secretary for such a committee.

Another new development was the def- ite assertion of the idea that fur farm- g is no substitute for wild fur manage- ent, any more than game farming is a bstitute for wild game management. his has an important bearing on forest r resources.

A special session on forests and wildlife iscussed the moose overgrazing problem h Isle Royale, the role of fire in the man- gement of forest game, the overgrazing f the Pennsylvania deer range, and some rizona research on deer nutrition and hysiology. A special session on land pol- y reiterated the argument (heretofore resented in this JOURNAL) that the recent read of public ownership is serving to ask the failure of private initiative in th forestry and game management.

Of special interest to foresters is the ntative organization of a Society of merican Game Managers, with W. L. cAtee of the U. S. Biological Survey as mporary president. The primary pur- se of this new organization is to estab- sh a journal of game management which ill convey to the hundreds of field work- s now engaged in game work in C.C.C. d other field camps the current prog- ss in game management technique. The gument is that these detached workers nnot subscribe to all the technical jour- als in which such material now appears. o journal is to be launched until the d of the year. The question of whether also to form a closed professional society was left in abeyance.

The conference papers are to be published shortly as a continuation of the annual volume of Transactions of the American Game Conference.

ALDO LEOPOLD,
University of Wisconsin.

APPOINTMENT OF GEORGIA STATE FORESTER QUESTIONED

Under date of March 16, the following correspondence was issued as a Society press release.

Hon. Eugene Talmadge,
Governor of Georgia,
Atlanta, Ga.

DEAR SIR:

The Society of American Foresters, which is the professional organization of foresters in the United States, comprising 3,200 members, has carefully investigated the recent appointment of Mr. Elmer Dyal as State Forester and finds that in making this appointment, the laws of the State of Georgia have not been observed. The statute requires that "The State Forester shall be a technically trained forester with at least two years' experience in technical and administrative work." Sec. 4, Forestry Administrative Act, Aug. 14, 1925.

We find that Mr. Dyal is not in any sense of the word a technically trained forester and that he has never had an hour's technical instruction in any school or department of forestry. The state of Georgia has since 1906 maintained at Athens a school of forestry for the technical training of the citizens to fill positions of this character in the state service. There are some 71 graduates of this institution, yet no effort appears to have been made to give any of these citizens, educated at the taxpayers' expense, a chance to be considered for this position.

Personal qualifications in the absence of professional training do not qualify a man for administering the problems of forestry practice and the retention of an untrained man must result in inevitable mismanagement of such problems through inability to grasp the fundamental requirements of the job.

We therefore urge you, and the members of the Forestry Commission who approved of this appointment, to reconsider this action in the interests of sound forest conservation and of the reputation of the State of Georgia, in order that state policy may be coordinated with that adopted by your educational system and approved by the public.

Very truly yours,
H. H. CHAPMAN,
President.

State of Georgia
Executive Department
Atlanta
March 6, 1936.

Mr. H. H. Chapman, President,
The Society of American Foresters,
Hill Building,
839 Seventeenth Street, N. W.,
Washington, D. C.

MY DEAR MR. CHAPMAN:

Your letter of the 4th has been received.

I am sure you do not know Mr. Dyal. He is a born forester. A wood ranger right. He was born down in the Okefinoke Swamp.

With all good wishes, I am
Very truly yours,
EUGENE TALMADGE,
Governor.

March 10, 1936.

Hon. Eugene Talmadge,
Governor of Georgia,
Atlanta, Georgia.

MY DEAR MR. TALMADGE:

In my previous letter I raised no question as to the excellence of personal character of the new appointee nor his familiarity with the woods. All my life I have been closely associated with woodsmen, timber cruisers and operators, for whom I have the greatest respect for their practical grasp of physical problems. They are not, however, foresters, born or otherwise, any more than a practical nurse is a doctor, or a foreman of a construction crew is an engineer. A forester is a man who by educational training has mastered a profession. These men have not done so. The state law makes it mandatory that the State forester be professionally or technically trained. The State College of Forestry has given this training to seventy-two graduates. If men without this training can be appointed to the highest position which the state offers in forestry, then the law should be repealed and the College of Forestry abolished.

Sincerely,
H. H. CHAPMAN,
President.

THE SECOND INTERNATIONAL CONGRESS OF FORESTRY

The official announcement of the Second International Congress of Forestry is now available. The place of meeting is Budapest, Hungary; the dates, Sept. 1 to 14, 1936.

The following paragraphs are from or based upon that statement:

"The aims of the Congress are to bring about, with international cooperation, a proper balance between forest growth on the one hand and timber consumption on the other, and to endeavor to solve the numerous problems connected with forestry, the timber trade, and the utilization of wood."

"The organization of the Congress is in the hands of the Central Committee of

Organization, appointed by the Ministry of Agriculture. The address is Kossuth Lajos-ter 11, Budapest V., Hungary."

Delegates are those who are representatives of their governments, or of recognized institutions connected with forestry. They have the right to participate in the discussions of the Congress. Each delegate has one vote. Delegates pay a subscription fee of 50 pengös. (The pengö is now quoted at 30 cents, United States money.) This fee covers the membership card, badge, and the official papers of the Congress. Wives and friends accompanying the delegates are classed as Associate Delegates. For them the fee is 30 pengös.

"The Congress comprises nine sections, as follows: 1, forest statistics, forest policy, forest economics, legislation; 2, Forest management, education, and research; 3, Trade in timber and other forest products; 4, Utilization and industry of forests; 5, Mechanical and chemical technology of wood; 6, Silviculture and plant production; 7, Regulation of forest streams, protection of soils and forests; 8, Various branches of rural economy and utilization, in connection with silviculture, protection of nature, recreation, etc.; 9, Tropical forestry. Under each section are listed various additional sub-headings. Delegates may attend the meetings of any section."

There will be both plenary sessions, at which speeches are limited to 10 minutes, and sectional meetings, where the opening speech to a motion must not be over 30 minutes, nor those of subsequent speakers over 10 minutes. Resolutions passed at the sectional meetings are communicated to the plenary sessions. They are then passed to the Executive Committee for further attention.

"The official languages of the Congress are French and Hungarian." Communications may be submitted, and delegates may speak, in any language they may choose, and may present motions in that language. But these cannot be discussed unless accompanied by French or Hungarian translations. Two typewritten copies of all papers are required. The printed text must not exceed 16 pages. Interpreters will be provided where possible at the sectional meetings, but this cannot be guaranteed.

Papers must be sent in advance to the Central Organizing Committee, which has the power of accepting or rejecting them. Papers will be received up to the end of May. Only the papers of those attending the meeting can be discussed. Those received from absentees may be published in the Proceedings, but cannot be read or made the basis of resolutions. At the end of each session the speakers must hand to the secretaries a summary, written in one of the two official languages.

Mention is made that "tours are open to both delegates and associate delegates," but no details are given of any such excursions. It is noted that "the International Committee of 'Carbone Carburant' (C.I.P.C.C.) meets in Budapest at the time of the Congress."

Pending a more formal arrangement in the way of a National Committee for the United States, with regard to delegates and the submission of papers, the undersigned, as Chairman of the Committee on International Relations of the Society of American Foresters, will undertake to correspond with the Central Committee of Organization at Budapest about the acceptance of papers, under the terms set forth above, which members of the Society who expect to attend the Congress may desire to submit. He would also be glad to hear at once from all those who have in mind to attend the Congress. All such letters should be addressed to him at the Department of Forestry, Cornell University, Ithaca, N. Y.

There is also to be held in Sopron,

Hungary, August 25 to Sept. 8, 1936, the Ninth Congress of the International Union of Forest Research Organizations. The meetings and excursions of this Congress are open only to members of the Union, but a Forest Experiment Station which is a member of the Union may delegate some responsible forester to represent it. There is no connection between the Union and the Second International Congress of Forestry, nor are there any joint excursions.

RALPH S. HOSMER,
Chairman, Committee on International Relations.

FORESTRY EDUCATION NOTES

A preforestry course has been inaugurated at the Clemson Agricultural College of South Carolina. The teaching of forestry at Clemson was begun a year ago, when Robert A. Cockrell was added to the faculty as Associate Professor of Forestry. The program finally decided upon consisted of the two-year preforestry curriculum and three courses designed for students in agriculture. O of these, general forestry, is required all agricultural students; the other tw the care and treatment of woodlands an the management of woodlands, are on semester elective courses for third- an fourth-year students. In September, 193 32 freshmen enrolled in the preforest program. No thought of expanding give professional training in forestry entertained at this time.

The curriculum of the preforestry cour is shown in Table 1.

Students are advised to decide by th end of freshman year to which forest school they desire to transfer, so that th courses of the sophomore year may be a ranged to meet the particular requir ments of that institution.

On January 1, R. H. Westveld too charge of the development of instructio in forestry at the University of Missour A two-year preforestry course will b offered; also a course in forest conserv tion as a cultural subject for studen generally. The University will emplo

TABLE 1

CLEMSON COLLEGE PREFORESTRY CURRICULUM

Freshman

First semester	Hours	Second semester	Hou
Bot. 13. Agricultural	2⅔	Bot. 14. Agricultural	3
Chem. 11. General	3⅔	Chem. 12. General	3
Drawing 11. Freehand	⅔	Drawing 12. Mechanical	
Eng. 15. Comp. & Am. Lit.	3	Eng. 16. Comp. & Am. Lit.	3
Math. 11. Plane Trigonometry	5	Math. 12. College Algebra & Analytic Geom.	5
Hist. 14. Am. Econ. History	2	For. 22. Forestry (General)	2
M. E. 16. Woodwork	⅔	M. S. 12. Military Science	1
M. S. 11. Military Science	1		
	18⅔		18

Sophomore

Eng. 21. Eng. Lit. & Am. Comp.	2	Eng. 22. Eng. Lit. & Adv. Comp.	2
Geol. 21. Agri. Geol.	3	Geol. 42. Meteorology	2
Physics 29. General	4⅓	Z. & E. 12. Gen. Zoology	3
For. 21. Dendrology	3	Bot. 30. Plant Physiology	3
C. E. 21. Surveying	3⅓	C. E. 22. Surveying	3
E. & G. 21. Elem. Econ.	2	E. & G. 31. Contemporary Econ. Problems	3
M. S. 21. Military Science	1	M. S. 22. Military Science	1
	18⅔		18

n Extension Forester in the near future.

Professor Westveld has had varied forstry experience. After graduation from Michigan State College in 1922 he spent 3½ years on administrative work with he U. S. Forest Service in New Mexico; ompleted work for the M. F. degree at ale in 1925; joined the Pacific Northvest Forest Experiment Station at Portand, Oreg.; and in 1928 went to Michian State College. He is author of the ecently published "Applied Silviculture n the United States."

Ward Shepard, adviser to John Collier, Commissioner of Indian Affairs, has been ranted leave of absence from the Departnent of the Interior, effective May 1, so hat he may undertake duties as Director f the Harvard Forest School, Harvard niversity.

The purpose of the Harvard appointent, as expressed by President James B. Conant, is to make a study of the posibility of strengthening and expanding orestry instruction in Harvard University n the direction of advanced preparation f carefully selected students, not only in he biological aspects of forestry, but in he complex economic, legislative, and inancial problems connected with the ubstitution of forestry for destructive forst liquidation.

Men and women interested in forestry nd wildlife conservation will have an pportunity to receive special instruction n that field at Michigan State College. he first short course of eight weeks will e offered during January and February, 937. Instructors will be members of the egular teaching staffs of the forestry, oology, and entomology departments of he college.

During the last year the college has eceived many inquiries concerning short ourses and correspondence work in conervation. The course to be offered is designed especially for woodsmen, caretakers of hunting, fishing, and recreational properties, and others interested in the administration of forested and other game producing areas. The work will be of a practical type, including mapping, identification of plants and animals, cruising, forest and game protection, reforestation, and allied subjects.

At Pennsylvania State College, courses in wildlife conservation and management are offered as part of various four-year curicula, including that in forestry.

Two new correspondence courses, one entitled "Grasses," the other "Ecology," are being offered by the Department of College Extension Courses, at the North Dakota Agricultural College of Fargo, North Dakota. Both courses are being given by Dr. Herbert C. Hanson, head of the Department of Botany. Dr. Hanson is the author of numerous papers in ecology and range management and is serving on several committees of the Ecological Society of America.

The course in grasses covers about 45 different kinds of grasses. The characteristics and habits of these species are thoroughly studied. The course in ecology is a basic course, and includes such subjects as succession, processes involved in plant succession, indicator plants, interrelationships of plants and animals, influence of environmental conditions upon plants and animals, and other important principles, concepts, and terminology. College credits will be given to properly qualified students who complete the courses satisfactorily.

Field employees of the Forestry Commission of Arkansas are given an opportunity to study forestry through the medium of a correspondence course offered by the Branch of Public Relations, with the assistance of other branches of the Commission. The subjects include for-

est protection, forest botany, silviculture, management, utilization, and general forestry. Each will comprise from eight to twelve lessons. The course is confined to employees of the State Forestry Commission and men in C.C.C. camps administered by the Commission.

Growing High-Quality Timber

Lumber free from knots and other defects because of its valuable technical qualities has always commanded a high premium. Good forest management requires that as much high-quality timber as possible be grown. Two means have been used to reduce knots: (1) pruning, and (2) close spacing in even-aged stands, which improves natural pruning. A third method has been under trial at Soro, Denmark, by Skovrider Mundt,[1] whom the writer, in company with S. O. Heiberg, had the good fortune to visit while traveling in Europe last summer as a fellow of the Oberlander Trust.

Mundt uses a modified selection system of silviculture. The essential features of the method are to allow the young trees to develop under an overwood until they have attained a length of about 20 to 30 feet clear of branches. This may take 30 to 50 years or longer. By the end of this time the future crop tree is merely a whip, with a small insignificant crown at the top. From this time on regular thinning at 2 or 3 year intervals are carried out, so that the tree gradually increases in rate of growth and develops a full, almost spherical crown. Within a period of 30 years a tree barely 5 inches in diameter may grow to 18 inches and produce a fine, clean bole practically 100 per cent clear of knots. A cross section of the stem of such a tree will show very narrow growth rings in the center, with gradually increasing rings to the exterior.

This system fully utilizes the growing space, because while young trees are being developed up to the stage where they are ready for the "fattening process," other crop trees are utilizing most of the light and soil, and when their turn comes they are forced into full development as rapidly as possible. While this system works better with a mixed uneven-aged forest, it can be initiated successfully in pure even-aged stands. The young trees should be started from small groups among the larger ones in this case.

A high degree of skill is required in marking trees to produce the desired results, but with care and patience a very fine quality of product can be grown. The method has the further advantage of maintaining the forest always in an aesthetic, healthy, and natural condition which renders it more resistant to attacks by insect or fungi and less vulnerable to wind or frost injury.

Hardy L. Shirley,
Lake States Forest Exp. Sta.,
U. S. Forest Service

[1]Mundt, H. Good forests and thinnings. The Scottish Forestry Journal 48: 121-141.

REVIEWS

More Food for Upland Game. By W. Gard Conklin and James N. Morton. *The Board of Game Commissioners, Harrisburg, Pennsylvania. Bulletin No. 11 (Fourth edition) Pp. 38. Illustrated. 1935.*

Wildlife as a forest value and game as a forest crop are slowly attaining recognition in forest management. As is pointed out by the authors, both of whom are foresters, the attempt to produce the greatest yield of the best timber in the shortest time may work to the detriment of other forest crops, among which is game. Many of the trees and shrubs which supply food for upland game birds and animals are commonly classified by foresters as weeds. The replacement of these trees and shrubs by a few more feet of timber per acre often dispels from the forest a crop which is not dependent upon fluctuating markets for its value, and for which there are no substitutes.

Natural food species—shrubs, trees, vines, grains, and grasses—ordinarily will not grow under dense timber stands. Planting for game food, therefore, must be confined to openings, borders, and fields where there is sufficient sunlight for their growth.

In order that the forests of Pennsylvania may supply game for a half-million sportsmen, the natural food and that from artificially planted stock must be further supplemented, particularly in winter, by emergency feeding. Many methods of feeding have been tried, including dropping paper sacks of grain from airplanes and building elaborate feeding stations; but the most satisfactory results have been attained by distributing food under natural cover or in artificial stations which simulate natural conditions.

Ten types of feeding stations are adequately described and illustrated with sketches. They are simple in design and inexpensive in construction, and are adaptable to varying conditions and materials. Most of them are the products of long experience in game feeding and management, and have been tried successfully in the field. A list of Pennsylvania upland game is supplemented with discussions of normal food requirements and suggestions as to the best food for emergency feeding.

Although the bulletin is based primarily on experience in Pennsylvania, game managers throughout the country may profit by the well written, amply illustrated text. Pennsylvania's problems are those of many other regions, and her success in meeting them has gained her a prominent place in the van of sustained game production.

ALBERT G. HALL,
U. S. Forest Service.

Once in a Lifetime. By Ned H. Dearborn. *302 pp., 2 half-tones, 1 map. Charles E. Merrill Co., New York. 1935. Price $1.*

This is the latest in the increasing number of books on the Civilian Conservation Corps, but it may be said at once that this one is different. Its sub-title is "A Guide to the C.C.C. Camp," and that is what it really is. Its whole make up is adapted to use by the C.C.C. and the

style is most informal—usually quite slangy. The book is divided into 24 chapters, with short paragraphs and heavily printed paragraph headings—all making for quick finding and easy reading of the mass of information offered.

It begins with a foreword, "You're in the C.C.C. now," and then follow the eleven parts: the what, why, and how of the C.C.C.; chances to learn things interesting and useful; vocational interests; tools for learning and doing; studies of man and his world; spare-time activities and recreation; the Army and the C.C.C.; the U. S. Forest Service; soil conservation; the National Parks; and safety. The concluding chapter is entitled: "After Camp—What?"

Part III, "Vocational Interests," is very full and complete and should be of real value to the C.C.C. enrollee trying to find out what work or trade he wants to enter.

Captious critics may say that the author has overemphasized some subjects and neglected others, but the fact remains, in this reviewer's judgment, that the "guide" has been written most acceptably for the youth in the C.C.C. Written by an educator—the author is Dean of the Division of General Education in New York University—it contains a world of useful information and is very well designed for the purposes for which it was written. If this little volume is placed in the C.C.C. camps, it is a certainty that it will prove the most popular book there.

JOHN D. GUTHRIE,
U. S. Forest Service.

Diametral Changes in Tree Trunks. By Ferdinand W. Haasis. *Carnegie Institution of Washington. Pub. 450. 103 pp., 4 pl., 31 figs. 1934.*

Following development of the MacDougal dendrograph in 1918, a considerable body of data relating to diametral changes in tree trunks has accumulated. From time to time various agencies have collected data on diametral increase and decrease in tree stems, but the bulk of these records have been made at the laboratories of the Division of Plant Biology of the Carnegie Institution. In the report under consideration records made in the vicinity of the Coastal Laboratory have been assembled and interpreted.

"Diurnal shrinkage and nocturnal swelling in clear weather have been found to be the rule in practically all species which have formed the subjects of dendrographic study, gymnosperms, monocotyledons, and ring-porous and diffuse-porous dicotyledons. With the exception of a species of large cactus, the pattern of diurnal fluctuation is much the same for all plants studied. Weather conditions cause pronounced modifications of this pattern; any increase in the integrated evaporativity of the environment is reflected in an increased shrinkage in tree trunks, and vice versa.

"Shrinkage of trees of various species may occur during a dry summer or autumn, during the dormant season of both evergreen and coniferous trees, and during the period of leaf development in the spring. When water again becomes available to the roots of a tree which has suffered dry-season shrinkage, enlargement ensues. Trees with a plentiful water supply do not experience dry-season shrinkage. Bole swelling may occur at night even though the tree is undergoing definite shrinkage from day to day. When water is available only in excessively small amounts while transpiration continues active each day, shrinkage must ensue. Seasonal shrinkage is closely related to diurnal shrinkage.

"Increase in diameter of a plant stem may be due to growth or to the rehydration of previously dried tissues. The two processes may occur very close together as to time, perhaps even simultaneously. When detailed measurements of diametral

changes are begun subsequent to a period of shrinkage, any increase observed should be regarded as including rehydration effects as well as those due to actual growth. Growth is primarily dependent upon an adequate water supply and sufficient heat; both these factors may vary considerably. It appears that ordinarily cell division can take place only when the cells are turgid or nearly so; the growing tissue is not usually turgid at the time the tree bole is shrinking; and growth, therefore, is not to be expected during the daytime in clear weather. It may also be inhibited by low temperatures. There is some evidence that when moisture conditions are exceptionally favorable, growth may occur in the daytime. There is also indication that food substances elaborated by the leaves are frequently used first nearest the point of production. If there is a deficient amount of these materials at any time, growth of the lower bole may fail to take place. Cambial activity is not necessarily the same in all parts of the tree."

This publication will be welcomed by plant physiologists, ecologists, and foresters alike, since it summarizes in a clear way the excellent work which has been carried on at the Coastal Laboratory over a considerable period of time. The author is to be complimented on his painstaking work and scholarly report. The present volume measures up to the high standard of excellence which scientists have come to expect in Carnegie Institution publications.

H. J. Lutz,
Yale University.

Meddelanden fran Statens Skogsförsöksanstalt. (Report of Swedish Forest Experiment Station.) *Vol. 28, 761 pp., map. Stockholm, 1935.*

This thick volume, containing eight major articles on many phases of forestry, is well up to the high standard of previous reports of this institute. The first 268 pages are occupied with a report on bark-borer outbreaks, already reviewed in these pages (5). In a paper on a proposed forest soils classification for Sweden Tamm quite properly stresses that this should be based on characteristics which can be observed without difficulty in the field. As forest soils are the result of a complex of factors, many of these must be considered, including geologic structure and origin, climate, ground water relations, vegetation, humus and profile. Fifteen types are described for southern Sweden and an equal number for northern Sweden, with a special classification for cut-over and waste land.

Langlet presents a very complete (113 pp.) discussion of different expressions for air temperature and its duration of action as limiting the range of plants. He draws largely on the duration curves, or "thermisochrones," of Enquist (2), (3) whose climatic constants for the ranges of forest trees deserve more careful study in this country than they have so far received. Langlet, however, although emphasizing the importance of duration-of-temperature extremes, fails to confirm all of Enquist's theories. Their limits of distribution of the important forest trees in Sweden are determined only partly by temperature factors; furthermore, until the exact effect of temperature on plants is better known Enquist's constants can serve only as rough indicators. Tiren's paper on periodicity of seed years is one of the most thorough studies of this subject ever made for forest trees. Starting with a study of bud formation, he shows that the possibility of a tree flowering, assuming weather conditions are favorable, depends on the number of axillary buds (male) or terminal buds on side shoots (female) which formed as flower buds the previous season. Heavy flowering tends to prevent

growth at these points, with the result that a smaller number of potential flowering points is present. This "bud reduction" is most important in controlling the frequency of flowering (and cone production) in trees which show no spontaneous innate periodicity. An analysis of 30 years of seed crop reports indicates that the influence of bud reduction lasts for at least two years after a heavy flowering. Temperature during short critical periods of bud formation, flowering, and ripening also seems to be important.

Hesselman is author of two articles, one a detailed proof of the pasture origin of a tract suggested for reservation as a virgin area, and the other a detailed study of the distribution of pine, spruce, and mixed pine-spruce types in the northern half of the country, to which is appended a beautifully colored map.

Few volumes of this superbly printed report are without profusely illustrated pages on some aspect of bog ecology, usually by Dr. Carl Malmström; nor does he disappoint us in the present number. His paper this time deals with nutrition conditions in bogs, and reports experiments in fertilization of drained bog lands with wood ashes in an attempt to stimulate forest production. Improvement in both character of ground vegetation and color of forest foliage was noted. Acidity was reduced and other ions became more available.

Näslund reports further results of experiments in thinning very dense spruce stands on cold soil in northern Sweden. The reviewer first visited these plots in 1923, and has described the conditions in an article in this journal (1) and reviewed a report by Ronge (4) dealing with early results. It now appears that since the largest trees show the best growth after thinning, and small trees react much more slowly, a form of low thinning is indicated. In most cases thinning from above is favored in Sweden, but here lack of market for even dominants in these young stands is a further argument for retaining the largest trees. Thinning trees 2.5 inches d.b.h. to about 6 x 6 feet spacing is recommended. The spacing should be wider where markets are poor.

When one considers the magnificence of such a forest experiment station report from a small country like Sweden, it is difficult to avoid reflecting on the less favorable situation for the publication of research in the United States. The annual expenditures in the United States for each one of the many regional experiment stations are comparable to those for the one central station in Sweden, yet where can results be published? In Sweden and in other European countries it is recognized that publication is an integral part of any research, and the most enduring of any phase. Certainly if skimping is to be done it should not come in the publication fund. Many research reports published in this country are of scientific value equal to or greater than papers herein mentioned. They deserve the best presentation. The present volume should be widely circulated among foresters engaged in research, not so much for reading (each paper is accompanied by a resumé in German or English) but as a model of scientific publication.

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HENRY I. BALDWIN,
Caroline A. Fox Research and Demonstration Forest.

Little Waters—A Study of Headwater Streams and Other Little Waters, Their Use and Relations to the Land. By H. S. Person, with Johnston Coil and Robt. T. Beall. *82 pp., 44 half tones, 11 figs., 2 maps. Government Printing Office, Washington, 1936. Price 50c.*

This is a very interesting and illuminating little book written for the Soil Conservation Service, Resettlement Administration, and Rural Electrification Administration. It is on good paper, with large type, and is easily read; there is an attractive cover in 3 colors (contour map). In fact, it is so attractive a book that one would never suspect its being a government publication, except for the tell-tale "letters of transmittal" at the front.

The book tells the story in a popular way of the intimate relationships between the headwaters, "the little waters," and land and all that depend on land—forest and other vegetative crops, wildlife, fish, and man. The treatment is modern, just as are the charts, type, and entire format of the book.

The contents consist of a foreword, Land and Man; three parts, Patient Nature, Impetuous Man, and Man and Nature; and a postscript, Man and Land.

The foreword is clear-cut, full of real facts. Part I is particularly good, informative, helpful, and clearly stated; Part II is equally good. Part III is much longer and more discoursive, with longer paragraphs, longer sentences, and a tendency to use longer or scientific words; someone might say it is a trifle argumentative and propagandic in spots. The story of the Coon Valley (Wisc.) experiment is particularly clear and convincing. The postscript summarizes the entire relationship between water, land, forests, wildlife, and man. The whole book ties in so closely with water, soils, trees, crops, human life, wildlife—the *real* things of life and their interrelations—that every forester should read it. Foresters could study it to good advantage as a splendid example of how to prepare the results of their studies, experiments, and investigations for public use and interest. The book should be in every C.C.C. camp.

JOHN D. GUTHRIE,
U. S. Forest Service.

Timber Growing and Logging Practice in the Southwest and in the Black Hills Region. By G. A. Pearson and R. E. Marsh. *U. S. Dept. Agric. Tech. Bull. 480, 80 pp., 24 figs. 1935.*

It has seldom happened in this country that an investigator has been able to follow a definite major problem of silviculture for over thirty years, as has been the case with Pearson's study of timber growing and logging practice in the states of Arizona and New Mexico. The bulletin now published is not only the last word on the problem of reproduction of ponderosa pine in this region, but is also the latest of a series of notable contributions on the subject, from 1928 to date, by this author, including Bulletin 1105 (1928), Technical Bulletin 247 (1931), and several articles, listed in the citations. Marsh, formerly Supervisor of the Coconino National Forest and Chief

of Forest Management for Region 3, as coauthor contributed from his intimate knowledge of the logging factors.

With nearly 85 per cent of the entire forest area in these states composed of stands of practically pure ponderosa pine, all located in areas accessible to grazing and bearing a heavy cover of grasses, it was natural that the influence of grazing upon reproduction should emerge as a problem of major importance. Grazing is rightly regarded as inseparable from forest management, and damage may be avoided by improved methods of range management, with special reference to number of stock, distribution, and seasons for grazing. The fact that seedlings under 2 years old can be exterminated by grazing is again emphasized. (The reviewer called attention to this fact in 1918, on a field trip with Albert Potter, Paul Redington, and Ward Shepard, at the Bly Ranger Station on the Coconino.) Recovery of seedlings of greater ages after severe browsing is one of the facts learned subsequent to the lightening of the grazing load, about 1925.

This bulletin gives the results of constant intensive study of the relation of grazing to reproduction, but only as one of the several factors influencing timber growing. Emphasis is placed on the preservation of soil cover for the absorption of water, in order to insure reproduction and full utilization of the land. Fire protection and slash disposal are well covered, as well as control of insects, birds, mammals, and diseases. The control of porcupines and of mistletoe are important elements in protection.

The general conclusion is that the practice of intensive forest production is possible only under public ownership. Planting is impractical and natural restocking must be relied on for reproduction. This should be obtained in advance of logging, for the most part.

Forest management in the ponderosa pine type on the National Forests of the Southwest is well in hand. The credit for this result may largely be attributed to the facts that the fundamental principles governing reproduction in this type were early established by painstaking investigations, and that the administrative men, with few exceptions, undertook, as foresters, to carry out the necessary restrictions, and succeeded despite many obstacles.

H. H. CHAPMAN,
Yale School of Forestry.

Holz, Blattmenge und Zuwachs. (Wood, Quantity of Foliage, and Growth.) I. Die Weymouthsföhre (White Pine), II. Die Douglasie (Douglas Fir). By Hans Burger. *Mitteilungen der Schweizerischen Anstalt für das forstliche Versuchswesen. Vol. 15, pp. 243-292. 4 figs. 1929 and Vol. 19, pp. 21-72. 8 figs. 1935.*

Comprehensive investigations of two important American timber trees which have become established in European silviculture are presented under the above titles. The interrelationships of wood quality, leaf area, and volume growth, as set forth by the author, merit the careful consideration of all foresters who are engaged in the management of young stands of coniferous timber.

The moisture content of the wood, its specific weight, and its volumetric shrinkage were determined separately for heartwood and sapwood from stands of different ages. Relationships were determined between the volume of wood produced and the quantity of the needles, as expressed by their green and dry weights and their superficial area. Wood samples were taken at 4-meter intervals along the tree stems. Growth in diameter was measured on 12 radii of cross sections cut at each of these points.

The ratio of dry weight of needles to dry weight of the wood currently produced decreases somewhat with increase in size of the trees, owing to shading of the lower portion of the crown. This is much more evident in white pine than in the more tolerant Douglas fir.

Rather surprising to American foresters may be the impression of the undesirability of Douglas fir as a timber tree in the Swiss forests. It produces inferior pulpwood; its too wide growth rings and many knots make it suitable only for use as squared timbers. It is only slightly stronger than fir and spruce. If grown very slowly, so that the annual rings are narrow, it produces darker colored heartwood, with smaller knots, and is suitable for trim, furniture, window frames, etc., but when grown in this way the author questions whether it may compete advantageously with the native larch. Also, Douglas fir is subject to considerable damage by fungi in both Germany and Switzerland. The final sentence is a question:—"Will Douglas fir disappear from the forests of Europe?"

BENSON H. PAUL,
Forest Products Laboratory,
U. S. Forest Service.

Visibility Photometers for Measuring Atmospheric Transparency and **A Photoelectric Method of Measuring the Transparency of the Lower Atmosphere.** By George M. Byram. *Journal of the Optical Society of America, Vol. 25, pp. 388-395. 6 figs. 1935.*

The author is the inventor of the haze meter now used by lookouts in the North Pacific Region of the Forest Service to measure visibility conditions. The articles contain some of the more important results of his studies in the fundamental physics of visibility. Foresters will be interested in these articles because they describe the haze meter and explain its theory. The other new devices for measuring atmospheric conditions that are described will be of interest to research workers in visibility problems, whether they are foresters or physicists. Not only is Byram's work of immediate practical value, but the publication of his results in the Optical Journal is also a merited recognition of the contribution he has made to pure science.

DONALD N. MATTHEWS,
Pacific Northwest Forest Experiment Station.

Holzfehler (Timber Defects). By Hermann Knuchel. *119 pp. Illus. Büchler & Co. Bern, 1934.*

This booklet, prepared at the suggestion of "Lignum" (the Swiss association of wood using industries), describes the various types of defects which occur in timber and points out how the occurrence of these defects can be diminished through proper silviculture and woods practices. Although prepared chiefly for Swiss readers, there is a great deal in this pamphlet which will interest American foresters. This is particularly true of the defects caused by improper silviculture.

The first chapter deals with defects in form of stem, such as crookedness, forking, and limbiness. These may be due either to using the wrong source of seed or to environmental influences. It has been repeatedly demonstrated in European plantings that trees grown from seed from regions with a different climate from that of the new forest are often crooked, limby, and subject to mechanical and biological injuries. There is also evidence that seed from limby or crooked trees tends to produce similar ill-formed offspring. When these defects are caused by environment, silviculture

should be directed towards the early elimination of the poor trees.

In the second chapter defects in anatomical structure are described. An important anatomical defect is irregularity of growth rings. This usually results in uneven density and other physical properties of the wood which, as a result of unequal shrinkage in seasoning, cracks or splits radially and tangentially. Wood from leaning trees is undesirable because of eccentricity of growth with unequal density of wood on the upper and lower sides, and also because of differences in color and resin content. Spiral growth is undesirable because it usually results in warping of boards and cracking in beams. Pitch pockets and false heartwood formation, such as occurs in beech when attacked by fungus, also belong in this class of defects. The author discusses in considerable detail the defect of limbiness, and points out that attempts to correct this through pruning may, unless properly done, result in far more harm than good. Pruning of large trees is seldom advisable, especially when it involves the removal of live branches. Heavy pruning may so reduce the growth rate that little additional wood is laid on even during 40 years following pruning, and in many instances the wound heals badly and causes a weak place in the timber. Pruning should be done only on comparatively small selected trees with rapid growth, so that the wound will heal quickly. Branches should be removed while small, and only a few live ones taken.

The third chapter deals with defects caused by climatic factors. These include splitting and cracking due to shrinking; ring scaling and heart wood scaling; frost cracks; heat cracks due to dry, hot weather; lightning, snow, and wind damage; and sun scald. Proper silviculture, particularly the culture of mixed hardwood and conifer stands of uneven age, together with avoidance of heavy cutting, may do much to reduce injuries caused by unfavorable weather.

The fourth chapter covers damage caused by logging and defects resulting from improper handling of the product. The author points out particularly the need for care in felling, and warns against leaving injured trees in the woods, as these often become infected with fungus. Likewise when two or more trees are grown together he advises taking all or leaving all. When slash must be burned, the stems of remaining trees should be protected by covering with green branches. Various devices for minimizing skidding damage to logs and to roots of remaining trees are described.

The last chapter covers damage caused by animals and plants, including game, woodpeckers, insects, mistletoe, and fungi.

The booklet has excellent illustrations of the different types of defects.

H. L. Shirley,
Lake States Forest Exp. Sta.

Om Granens Kottsättning, dess Periodicitet och Samband med Temperatur och Nederbörd. (The Cone-setting of spruce, its periodicity and relation to temperature and precipitation.) With English summary. By Lars Tirén. *Meddelanden från Statens Skogsförsöksanstalt 28: 413-524. Stockholm, 1935.*

No other factor is so fundamental to forestry as the ability of forest trees to reproduce themselves. Yet we seem to take forest regeneration for granted. We devote much of our time to studies of mensuration, the effects of various treatments on growth, economics, logging costs, and so on—all of them important, it is true—but very little to studies of the seed produc-

tion of forest trees and the factors affecting it. An occasional European investigator has tapped this field, but as a rule has been hampered by insufficient data. In this country, there have been a few sporadic studies, but no comprehensive organized efforts.

The present paper is a distinct contribution on the subject. As reports upon cone production have been required from field men in the Swedish Forest Service since 1895, there are sufficient data to provide some significant results.

The author has divided Sweden into 25 equal squares, and for each has worked out the average abundance of spruce cones for each year from 1895 to 1933, and the deviations from normal of the mean temperature and precipitation for each of the summer months during the year of flowering and the preceding two years. The relations of cone abundance to reduction in number of buds, to temperature and to precipitation were analyzed statistically. Graphs and tables showing the results are included in the paper, as well as the more general results.

Tirén's conclusions seem to bear out the hypothesis, advanced by H. Schacht in 1860, that temperature during the year of bud formation (the year preceding flowering) is the only weather factor which has any marked influence on seed production. His results show a marked relationship between the cone yield and the temperature from June to mid-August of the year of bud formation. Supernormal temperatures forecast high yields, and subnormal temperatures low yields, the relationship being more marked for low than for high temperatures. Less detailed data indicate similar behavior for pine, beech, oak, and other species.

The author points out that his data do not support the theory that purely physiological conditions cause what has been called "spontaneous" periodicity. The effect of the midsummer temperatures during the year of bud formation may be modified by the number of years since the last heavy cone crop. In spruce the flower buds are terminal, consequently heavy cone crops reduce the number of new shoots and therefore the number of new flower buds which can be formed the next year. There must, then, be an interval of at least one or two years between heavy cone crops, regardless of high summer temperatures which would ordinarily forecast a good crop. Unlike spruce, the flower buds of pine are lateral, so that terminal buds are always available to produce vegetative growth the next year.

The English summary of this paper, though brief, gives a reasonably clear outline of the contents of the original text. Tables and graphs throughout the text contain English as well as Swedish captions.

It is the reviewer's earnest hope that American foresters will give increasing attention to the collection of reliable data regarding the seed crops of our important forest trees, so that we may some day have this necessary basis for rational forest management.

Paul O. Rudolf,
Lake States Forest Exp. Sta.
U. S. Forest Service.

CORRESPONDENCE

"The Cult of the Wilderness"

The following is taken from a letter to the Editor-in-Chief, evoked by the December Journal editorial:

I am intrigued . . . by your assertion that esthetic judgements are not the province of mere foresters, but require the aid of expert professional landscapers. I think I disagree with you. I suspect there are two categories of judgment which *cannot* be delegated to experts, which every man *must* judge for himself, and on which intuitive conclusion of the non-expert is perhaps as likely to be correct as that of the professional. One of these is what is right. The other is what is beautiful.

The question of the "highest use" of remaining wilderness is basically one of evaluating beauty, in the broadest ecological sense of that word.

Another way to say this same thing is that no one who does not sense the value of wilderness "in his bones" can learn that value through any process of logic or education.

If this is true, then the forester who has no opinion about it has simply got a "wane" on his spiritual board.

I am not much impressed with your logic in pitting wilderness beauty against landscaped beauty. Why argue whether the domestic fowl is more or less beautiful than the ivory-billed woodpecker? The question is irrelevant. The thing that matters is that the ivory-bill is beautiful, and, like the wilderness, irreplaceable and almost gone. Call this assertion a cult if you will,—that does not change its irrefutable logic.

To fully appreciate what it means to live in a country which has plenty of forests and wildlife, but which has lost all its wilderness, one must go to Germany and see the annual exodus of hunters and hikers to the still partly wild Carpathians.

But thanks again for your thought-provoking editorial.

Aldo Leopold.

Editor, Journal:

I appreciate very much the genuine improvement which your editorials have brought to the Journal of Forestry. Nevertheless, I found your editorial in the December Journal most disappointing. You first donate to the Wilderness Society some objectives which it does not hold, and after destroying these with the ease that straw men can always be destroyed, you proceed to various economic and aesthetic philosophizings which to me at least seem unsound.

At the bottom of page 956 you state: "For the Wilderness Society platform seems to base on a questionable assumption its belief that preservation of all the wilderness there is left in the country must be insisted upon, and brought to pass through an irresistible public demand."

What we actually say, in the very first page of the statement of our policies, is this:

"We do hold that those few areas which have thus far escaped man-made influences must be preserved in their natural condition, unless it can be clearly demonstrated that some other use is of compelling value."

In your last paragraph you say: "A

sound basis for public policy in determining where and to what extent wilderness should be preserved is to be sought not in transcendental or pantheistic nature idolatry but in our good old doctrine of obtaining through wise use, the largest measure of contribution to the welfare of everybody in the long run." Of course you're right provided you don't interpret this to mean that the greatest good to the greatest number in the long run applies to individual acres instead of to the land resources of the nation taken as a whole. We have said this same thing in slightly different words.

The Wilderness Society does not contend that no existing wilderness should ever be invaded. We definitely do believe, however, that the wilderness areas in America have been so decimated from the 1,903,000,000 acres of three centuries ago to less than 40,000,000 acres which are now possible, that no more wilderness invasion should be permitted unless there is an urgent reason. In other words, the burden of proof should rest on those who want to invade the wilderness.

For many years, as you well know, wilderness areas have been modified with practically no consideration of whether they might not be more valuable as wild forest lands and of whether they would not be cheaper to adminster in that condition. If anybody wanted to develop a wilderness area and money was available, it was the general rule to invade the wilderness without trying to balance values. As examples of wilderness invasion by different government bureaus, which seem to me to have been thoroughly unjustified on any basis of balanced values, I would cite the all-comprehensive road system of Rainier National Park, the Lochsa River highway, and the networking of the Selway country with truck trails, against which Elers Koch wrote so eloquently in the February, 1935, JOURNAL OF FORESTRY. I believe we are quite reasonable in holding that in the future this type of invasion should not be permitted unless it is of a compelling value. In a country with 1,903,000,000 acres, it does not seem extravagant to set aside some 40,000,000 acres of low commercial value as Wilderness, particularly when one considers that for every scenic type which is set aside for wilderness use, there is an equal or larger area made usable for motor recreation. This is our viewpoint, and I do not believe you are fair in calling it a cult which is "as irrational as to mourn the vanishing of the vast herds of buffalo before the advancing tide of human occupation of the prairie grasslands, or the hemming in of the stately Hudson by the straightening piers of commerce, or the migration of Europeans to establish a great Nation where once the Indian hunted his game or followed the warpath, in the depths of the unbroken forest that rose from the Atlantic Shore."

You also state that "wilderness camping, canoeing, trail-riding, and the like undertaken for pleasure, not because one's work necessitates it, call for a certain amount of free time and money. . . ." Of course they call for a certain amount of free time and money. Everything does. But they do not, as the implication seems to be, require any abnormal amount of free time and money. Most of our Wilderness Society members have incomes of less than $3,000 a year, and their vacations seldom are more than two or three weeks. This is not a great deal of money or time. I know of one of our members in Seattle who has been taking annual back packing trips of a couple of weeks' duration into the Olympic Wilderness. She is supporting three people besides herself on a teacher's salary of $1,500, and yet she manages to take this trip. Ovid Butler has demonstrated with his Trail Riders that people with relatively low incomes can take wilderness trips if reasonable arrangements are made. When I lived in Missoula, I knew a dozen or more people getting less than $2,400 a

year, and some of them less than $1,600, who each year took the trip with the Montana Mountaineers into some neighboring wilderness.

In the second column on page 957 you state: "The landscape architect knows better. That because dead trees are a feature of the natural woods any and every dead tree found in nature must be appropriate and beautiful in its place, or that because nature produces thickets or stagnated young growth scenic beauty is achieved on the roads and paths about a great country house by abstaining from judicious use of the ax, is obvious absurdity."

How do you know the landscape architect knows better? Can't both he and the wilderness lover be right on different areas? To many "the undisturbed handiwork of nature" really is "the supremely beautiful." There is nothing immoral or even low-brow about that. We do not even hint that dead trees should be preserved on formal estates or in managed forests. In fact, these do not concern the Wilderness Society. It seems unfair for you to distract attention from our real views by implying that we have urged the preservation of dead trees as a generality. We don't even mention them in our statement.

In the first column on page 957, you do not consider that aesthetics comes within the field of forestry. My own belief is that forest aesthetics is as legitimately the field of foresters as is silvicultural practices, fire protection, planting, or truck trail construction.

Your editorial, by imputing to the Wilderness Society a lot of views we do not hold and then jumping on them, has given to the forestry profession a totally erroneous conception of what the Wilderness Society stands for. By way of retribution, I am looking forward to an early editorial discussing the peril of the wilderness, and the need for vigorous action to save the rapidly dwindling remnant.

ROBERT MARSHALL,
Office of Indian Affairs.

Editor, JOURNAL:

I have read with interest your editorials in the November and December issues, on the wilderness, and I commend their general fairness and impartiality. The following comments have to do with these editorials, and if they sound critical, are intended to be so more in the strict than in the adverse sense.

The editorials, though excellently written, suffer from a stiffness of alternative. For example, they seem to propose the question: "We have in America *n* mountain peaks; shall we have *n* roads to their summits, or no roads?" Or again, they dwell upon the excesses to which, in the name of art, realism has gone, rather than on what is saner and vastly more important, that realism (the natural or romantic movement in art and letters) was a healthy change from decadent artificiality.

The fundamental principle which the Wilderness Society strives to uphold, in contrast, would seem to be that of moderation, the deprecation of extremes. From their viewpoint present policies threaten the annihilation of the wilderness, which annihilation, no one can deny, is certainly an extreme. Their study of our recreational resource reveals a shortsighted and selfish or indifferent pressure consuming the last remnants of a once vast wilderness. Their practical contention is that if all the few wilderness tracts now remaining could be preserved from mechanization, they would be a scant modicum to the Nation's aesthetic and scientific needs. If they should seem extreme in demanding that the destruction of wilderness cease, it is only because the opposite extreme is gone so far that there is no other way to decelerate it, and be-

cause temporizing can result only in failure.

This enthusiasm, this fervor, is no doubt what you recognize under the "cult of the wilderness." You are thoroughly justified in calling for rational consideration of the problem and avoidance of looseness of thought. The inference is not justified, however, that enthusiasm is irrational or the thoughts accompanying it loose. It is unemotional consideration that the JOURNAL OF FORESTRY is expected to give. But the JOURNAL OF FORESTRY must not lose sight of the fact that enthusiasm is in itself worthy, is much more likely than sober discussion to arouse interest and to result in achievement. Rational as men—and foresters—may believe themselves to be, the fact is incontrovertible that public opinion has never been swayed by reason alone.

Among the proponents of any worthy enterprise there are bound to be many motives and points of view, and even more ways of expressing them. But to the achievement of a worthy end, it is only waste motion for those who express themselves in the unspectacular idiom of figures and dry facts to use their efforts deriding those who offer a more imaginative appeal, with whom they should be pulling in harness. The need for wilderness must be eloquently put before the public if the movement is to succeed at all. It is the job of foresters to examine the facts and draw sane conclusions, and if they are not eloquent, not to disparage those who are.

The disparagement in the present instance arises from the false premise of a "third objective" in wilderness preservation. When examined, this is seen to be no separate objective at all, but only one phase, one perhaps minor part of the first, that is, the need of wilderness for physical and spiritual recreation. As I have just mentioned, there are as many motives as there are people behind such an enterprise; and that some advocates of wilderness preservation should approach it with an almost religious attitude does not discredit the main objective, nor should it obscure the fact that their point of view, through enlisting allied sympathies, may help to win the battle.

I shall not attempt to defend the so-called third premise, but refer only to the attack upon it.

The last four paragraphs of the second editorial (page 957) are a brief attempt to analyze the real aesthetic virtues of undisturbed nature. The very method of analysis used involves faulty reasoning: a spoon is an admirable utensil with which to eat porridge, but it avails little with beefsteak. So in this. There are authorities on art, on landscape design, and on aesthetic theory, but *there are no authorities on beauty*. Upon that subject one man's sincere conviction is just as sound, just as "true," as another's. I do not overlook the point that some are more sensitive to beauty than others, and in general, perhaps, that those with strong feelings for beauty are more likely to be employed in the arts rather than in technical pursuits. The mistake is in assuming that foresters are not qualified to understand beauty—it is "out of their line"—and that men whose business it is to arrange trees, lawns, and shrubbery in conformity with architecture are specially so qualified. To say that foresters arrogate if they attempt to judge in such matters is to say that foresters lack good sense.

The fact that primeval wilderness leaves a student of the Old Masters or Grecian sculpture cold does not in the least indicate that the wilderness is unbeautiful, for others who are not art students feel joy in it, but only that the particular art specialist is not awake to the particular wilderness type of beauty. That the great critic, Ruskin, had to have a castle in his panorama does not in the least

mean that a view lacking signs of human habitation is dreary to everyone else.

There is no justification for judging nature from the standpoint of art. I venture to say that, intelligence for intelligence, foresters are just as capable of being accurate judges of natural beauty as art critics. By their choice of the forestry profession they demonstrated an aptitude for the outdoors, an enthusiasm for the woods; and their daily tasks take them into that environment. True, some individuals may be "too busy" or "too practical" to attend to such things as the grandeur of mountain peaks or the exquisite colors of evening; but although most foresters are busy men, they have ample opportunity to develop a sensitivity to natural beauty. They are in a better place to judge of wilderness beauty, be they ever so shy and reluctant to express themselves, than the professional critics of architecture or conventional landscape.

No one can define beauty. It is a matter purely of feeling. Perhaps one may say that in all its varied forms beauty is closely allied with *fitness*. To infer that the Wilderness Society, in the interests of beauty, would preserve dead snags or tangled thickets on the grounds of a country house is to buffet a man of straw: neither the Wilderness Society nor anyone else in his right senses ever made such an assertion. It seems obvious that snags, rotten logs, and weedy growths are unsightly around a handsome dwelling, simply because they do not fit into the prevailing atmosphere of care and order.

In the same light, signs of forestry culture, such as thinning, not even to mention such banalities as automobile exhaust and Tin Pan Alley, are unfitting in a wilderness, and disrupt its beauty.

There is no one qualified to pass on the beauty in nature for others, and yet everyone is qualified to pass on beauty for himself. We cannot look to experts in any art for counsel because, although both are related to beauty, art and nature are separate manifestations of it, and art at least is a fickle instrument with which to measure nature. Thus, whether they like it or not, foresters are faced with another great responsibility. To try to avoid it under any subterfuge of incompetency is to avoid the load which is laid upon the shoulders of every citizen. The forester's responsibility is the greater because he is more familiar with wilderness than the ordinary citizen, and from that fact, and because he presumably has a leaning toward that type of beauty, he is the more competent to judge its values.

LINCOLN ELLISON,
U. S. Forest Service.

HOW MUCH PUBLIC FORESTRY?

Sandpoint, Idaho.
December 4, 1935.

Editor, JOURNAL:

I have just read A. E. Wackerman's article in the December issue of the JOURNAL, and am moved to protest against the argument advanced that "such a program [general public acquisition of forest lands] is a challenge to the profession itself." This argument, in brief, appears to be that a broad program of public acquisition of forest lands will concentrate control of forest policy in a few federal officials and will thereby deprive individual foresters of the opportunity of assuming leadership or acquiring and owning forests and forest products companies.

That centralization of authority and the consequent ability of a few men to dominate the field of forestry would follow in the wake of the proposed acquisition program is of itself a highly debatable question. But why does it follow that all the rest of the foresters would become mere automatons carrying out the orders of su-

periors, or that any individual, forester or otherwise, would be prevented from owning forests or forest products companies if he so chose?

Just what is the aim of the profession? Is it to pave the way for business careers for colleagues? Is it to put the ambitions of individual foresters above all else, so that they may have the "opportunity of demonstrating their ability in the business world"? Is it to entice the public into fostering and encouraging industrial forestry in order that foresters may assume the leadership thereof, share in the "financial profits," and gain the personal satisfaction of individual accomplishment? In short, is the profession dedicated to satisfying the personal desires of its members for positions of leadership or financial returns, regardless of the cost to the public or the rest of the profession? Certainly any thinking forester will answer in the negative.

Honest differences of opinion over the acquisition program proposed by the Copeland Report are to be expected. But I vehemently object to an argument that the program is a challenge to the profession itself because it would restrict the personal achievement of individual foresters. Regardless of an acquisition program, how can any of us argue that a proposed action is a challenge to the entire profession because it limits the liberty and opportunity of individuals in the profession to gain personal distinction? Such an argument completely loses sight of the ideals ingrained in most of us.

A. W. GREELEY,
U. S. Forest Service.

February 14, 1936.

Editor, JOURNAL:

I, an inconspicuous forester, have prepared the following, taken from the JOURNAL OF FORESTRY, vol. 34, pages 10 to 15, for the purpose of frightening my neighbors on October 30 next.

Title: "Bogey-men and Hobgoblins, or What Hoyle Found in the Mail Box."

Text: "Let us go out into the woods and stay there until we again know what the situation really is." JOURNAL OF FORESTRY, vol. 34, page 10.

". . . the practice of forestry and of growing timber has never been tried on any large scale in America, because it has always been economically impossible."

"It is only human nature for a man who is sure of his job to let down and coast along. . . . This is the reason that Forest Service men cannot be expected to be as efficient as private foresters."

". . . we see . . . regional foresters given associates to attend to the details of administration so they may devote more time to politics and social planning."

". . . the lumber business will be getting a —— Deal when the government steps in and purchases the raw materials upon which they expect to operate. . . ."

"The government has bought up several thousand acres right around our mill . . . and now the government is buying up our timberland and paying exorbitant prices for it."

". . . help need not be expected if the real objective is not to foster private industry, but rather to socialize forests and other natural resources."

". . . before another generation has passed . . . they [the Forestry Department] will be selling standing timber or logs to manufacturers, and most certainly a lot of these sales will be at prices with which the private owners cannot compete."

". . . what assurance have we that the same senseless . . . plans for social control of forestry would not be extended to all industries?"

". . . the government . . . is out to extend the public domain to such an extent that the people will no longer own the land."

(In connection with the writer of the last quotation, Hoyle states: ". . . he

knows what he is talking about.")

"The bureaucrats are so perfectly infatuated as they view themselves from the heights of their self-esteem that they will undertake anything at any cost—provided only that the bill is sent to somebody else."

Moral: It's not what a man says that is so pertinent, but why he says it.

EARL SMITH,
Lake Waccabuc, N. Y.

OPINIONS DIFFER

Washington, D. C.
January 6, 1936.

Editor, JOURNAL:

I do not presume to speak for all the members of the Society who are employees in the furtherance of the conservation measures of the Department of the Interior, nor to express their reaction to the various press releases of the Honorable, the President of the Society in regard to the establishment of a department of conservation, and his reflections on the caliber and deficiencies of the conservation work of the Department of the Interior.

From a discussion of the statements of the President, the general consensus of opinion is that there has been too much heat and not enough light on the subject and I do not wish to further agitate the controversy, but simply desire to state that in my opinion, and I believe it can be substantiated by many disinterested conservationists, good conservation has made as great progress in the various activities of the Department of the Interior since the advent of the Roosevelt Administration as in any other agency of the government.

Through the efforts of the Secretary and his conservation technical assistants, the Soil Erosion Service was instituted, the Indian lands were placed on a permanent sustained yield basis, the public domain closed to homestead entry, expansion of state park and recreational areas under sound conservation principles was greatly extended, and determined efforts made to safeguard our oil and mineral wealth. In addition to this, and possibly of greatest importance, has been the sponsorship of the National Planning Board and its successor, the National Resources Board, which has accomplished much in forwarding planned conservation in every state.

As to the errors in policy or practice of the past, I do not believe that any agency or individual of the government need long sing praises, but each might humbly say "forgive us our trespasses." The conservation of natural and human resources can not be the sole prerogative of any single department or bureau, but must permeate and become the policy of the entire government.

MATT C. HUPPUCH,
National Park Service.

February 5, 1936.

Editor, JOURNAL:

I like the editorial policy expressed on page 187 of the February, 1936, issue of the JOURNAL, which reads:

"The JOURNAL should be an instrument for the expression and formation of Society sentiment.

"Neither the President of the Society nor the Editor-in-Chief of the JOURNAL wish to use space in the JOURNAL merely to record praise. When, however, divergent views appear, the Society is entitled to hear from both sides."

My reaction to the correspondence appearing on this page is that the profession as a unit or as individual members speaks altogether too little and too meekly. The Society is fortunate, particularly in these times, in having a President who has the courage and conviction of speaking up in terms that are to the point and easily understood. I do not feel that the profession has been spoken for too much or too bit-

terly, in fact, I feel much more might have been said. Dignity is desirable at all times, but righteous indignation, even to the extent of personalities, is often just what is needed. Hidden, couched, double-meaning, diplomatic, vague literature is not what is wanted, for it takes too much space, often is not understood, and leaves too many loopholes.

It is to be expected that there will be differences of opinion on many subjects, but only by the expression of these opinions can we arrive at sound policies. May we have more honest expression of differences of opinion in following issues of the JOURNAL!

RAYMOND J. HOYLE,
The New York State College of Forestry.

FORESTERS ARE BIOLOGISTS

December 31, 1935.

Editor, JOURNAL:

I cannot comment too highly on the February article by Ira N. Gabrielson on the Correlation of Forestry and Wildlife Management, to whose tenets I heartily subscribe. Only one thing, may I add, would I like to comment on, that is regarding the statement that comparatively few foresters clearly conceive the forest as an interrelated community of living organisms, and that until recently few forest schools have included anything more than very inadequate courses in biology and ecology in their curricula.

In the study of forest education recently completed for all the institutions in which this subject is taught professionally, I find that the following hours represent the average taught in 18 schools, these representing the listed professional undergraduate institutions; the basis is semester hours, and approximately 16 hours are required per semester for all subjects, or 128 for graduation. In these 18 schools, 17 give 8 hours to botany, in 10 schools 4½ hours to plant physiology, and in addition 9 schools give 4 hours to zoology and 2½ hours to entomology. The basic biological subjects, including in the average the entire list of schools, totals 16½ hours, or one entire semester, which is one-eighth of the total. In addition the subjects of silvics and dendrology is a condition of the biological basis, and 18 schools give 8 additional semester hours to these subjects. I have not included the practical or applied sciences of soils, planting, treatment, woodland management, etc., in the above total.

The apparent activity of the young forester in the woods seems to be concentrated largely on engineering, timber cruising, and other subjects unrelated to biology simply for the reason that this work is there to be done, while the improvement, management, and silvicultural treatment of woods must often be temporarily postponed or is less conspicuous; but as above shown, these activities do not represent the basic biological training of the forester. The fundamental principle on which the entire schedule of professional forest education is based is that the forest is an interrelated community of living organisms, and the entire success of management depends upon the extent to which the professional forester has grasped this conception.

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THE RATE OF TREE TRANSPIRATION

January 10, 1936.

Editor, JOURNAL:

I wish to offer comment on what seems to be a serious error on page 39 of the January JOURNAL, in Minckler's calculation of total water transpiration per acre of American elm and red maple. He *assumes* 375 13-inch trees per acre for

his total acre calculations. This assumption carries a basal area of over 345 square feet per acre. According to Schwappach's 1911 normal tables for North Germany oak, site II, age 100 years, contains but 125 13-inch trees per acre in the main stand, with a basal area of 117 square feet, plus a secondary (thinning) stand of 20 smaller trees for which the basal area and average diameter are not given. These 20 thinning trees, according to volume given, would not equal more than 13 of the 13-inch main stand trees. *Ulmus americana* will not stand much denser than oak.

Red maple may be more comparable to beech in tolerance. Even beech, for site II, age 120 years (Schwappach), has an average diameter of 13.2 inches, basal area 104 square feet, with 112 trees in the main stand, and but 9 smaller trees in the secondary group per acre. It appears, therefore, that the calculated rainfall transpired per acre based on the published tree diameter is about 3 times too high. This basal area check from tested normal yield tables is a valuable aid in the theoretical assuming of fully stocked pure stands in the absence of measurements of such pure stands.

Different kinds of glass have different effects on the human body in transmitting elements of sunlight (long and short rays). Has the kind of glass used in the bell jar in this study a variable effect on plants also, in transmitting sunlight with less than full value?

Minckler's contribution to the experimental study of tree transpiration is an excellent one, and his publication of full data should be of great value.

E. A. Ziegler,
Pennsylvania Department of Forests and Waters.

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